FM 20-33

FIELD MANUAL

COMBAT FLAME OPERATIONS

HEADQUARTERS, DEPARTMENT OF THE ARMY

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***This manual supersedes FM 20-33, 2 June 1967, including all changes.**

CHAPTER 1

INTRODUCTION

1–1. Purpose and Scope

a. This manual provides doctrinal guidance in combat flame operations. It includes information pertaining to principles of employment of flame, ground flame operations, air flame operations, flame fuels, flame field expedients, flame equipment, and defense against flame.

b. The content of this manual is applicable to nuclear and nonnuclear warfare, internal defense and internal development operations, and operations by Special Forces.

c. The term "infantry," as used throughout the manual, applies to all types of infantry battalions—infantry, airborne infantry, mechanized infantry, airmobile infantry, and light infantry. The term "artillery," as used in the manual, refers to field artillery unless otherwise stated.

1–2. Recommended Changes and Comments

Users of this manual are encouraged to submit recommended changes and comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commanding Officer, U.S. Army Combat Developments Command Chemical-Biological-Radiological Agency, Fort McClellan, Alabama 36201.

1–3. Effects of Flame

Flame is a valuable close combat weapon for several reasons. These include the effects of burns, oxygen depletion, and psychological impact. Since man fears flame, it has a demoralizing effect on troops and has been successfully employed to reduce positions that resisted other forms of attack. Flame produces the following effects:

a. Casualty. Casualties result from: (1) burns—thickened fuel sticks to the clothing and skin, burns with intense heat, and the burning fuel is extremely difficult to extinguish; (2) inhalation of flame, hot gases, and carbon monoxide; (3) suffocation; and (4) shock.

b. Psychological. The psychological impact is probably one of the greatest effects of flame. In many cases, defending personnel will leave well-prepared positions and risk exposure to other weapons or capture. In other cases, the enemy is forced to withdraw from firing positions during the effective period of the flame attack. This withdrawal permits friendly forces to close in before the enemy reoccupies his firing positions.

c. Splatter. Flame can be used to reach around corners through the splattering and ricochet action of the thickened fuel on adjacent surfaces. The splattering action of the thickened fuel spreads the flame over an area in contrast to the point effects of nonfragmenting small arms ammunition.

d. Incendiary. Flame will ignite combustible materials to cause additional problems for defending personnel. Flame weapons can be used to ignite clothing, tentage, wires, petroleum products, buildings of light construction, light vegetation, munitions, and other combustible material.

e. Battlefield Illumination and Signaling. Controlled, slower burning flame field expedients can be used to provide close-in battlefield illumination and signaling effects at night. These devices can be made to vary in illumination time from a few minutes to hours.

f. Smoke. The burning fuel produces a dense black smoke that can cause appreciable reduction of battlefield visibility. Additional smoke from ignited material may prolong the visibility limitations. However, the black smoke could attract the attention of the enemy to a flamethrower attack and invite counterfire. The presence of the smoke must be anticipated to minimize any hindrance to friendly operations.

1-4. Flame Weapons

a. General. The flame weapons available are the XM202 rocket launcher and the mechanized and portable flamethrowers.

b. XM202 Rocket Launcher. This weapon fires a rocket that delivers pyrophoric fuel to the target. On impact the fuel is exposed to the air and ignites, thus eliminating the waste of fuel burning en route to the target. This weapon is more efficient and has a greater range than either the portable or the mechanized flamethrower, and can be employed in most areas in which flamethrowers are employed. This weapon is a limited production item. Ammunition (XM74 rocket clip) is available as a class V item of supply.

c. Mechanized and Portable Flamethrowers. These flamethrowers deliver burning fuel on the target. Two types of fuel are available for these weapons: thickened and unthickened. A thickening agent is currently available as a class V item of supply. Thickened fuel gives greater range and accuracy because it is projected as a rod (fig. 1-1). The thickened fuel sticks to the target and burns with intense heat. Unthickened fuel burns more rapidly in the air to produce a billowing effect (fig 1-2). When unthickened fuel is used in the portable flamethrower, its range is about one-half that of thickened fuel. Thickened fuel is normally used in the mechanized flamethrower. Since it will penetrate small openings, thickened fuel is more effective than unthickened fuel against inclosed fortifications. Unthickened fuel can be used effectively to ignite combustible material, such as dry vegetation, and to produce casualties when used against fortifications where the openings are large enough for the billowing fuel to enter.

1-5. Targets for Flame Attack

a. General. In selecting targets for flame attack, consideration must be given to the type of flame weapon available and, in the case of the flamethrower, the appropriate fuel for the type of target to be attached. Table 1-1 shows targets suitable for flame attack and the expected effectiveness of flame weapons and fuel for firing against specific targets.

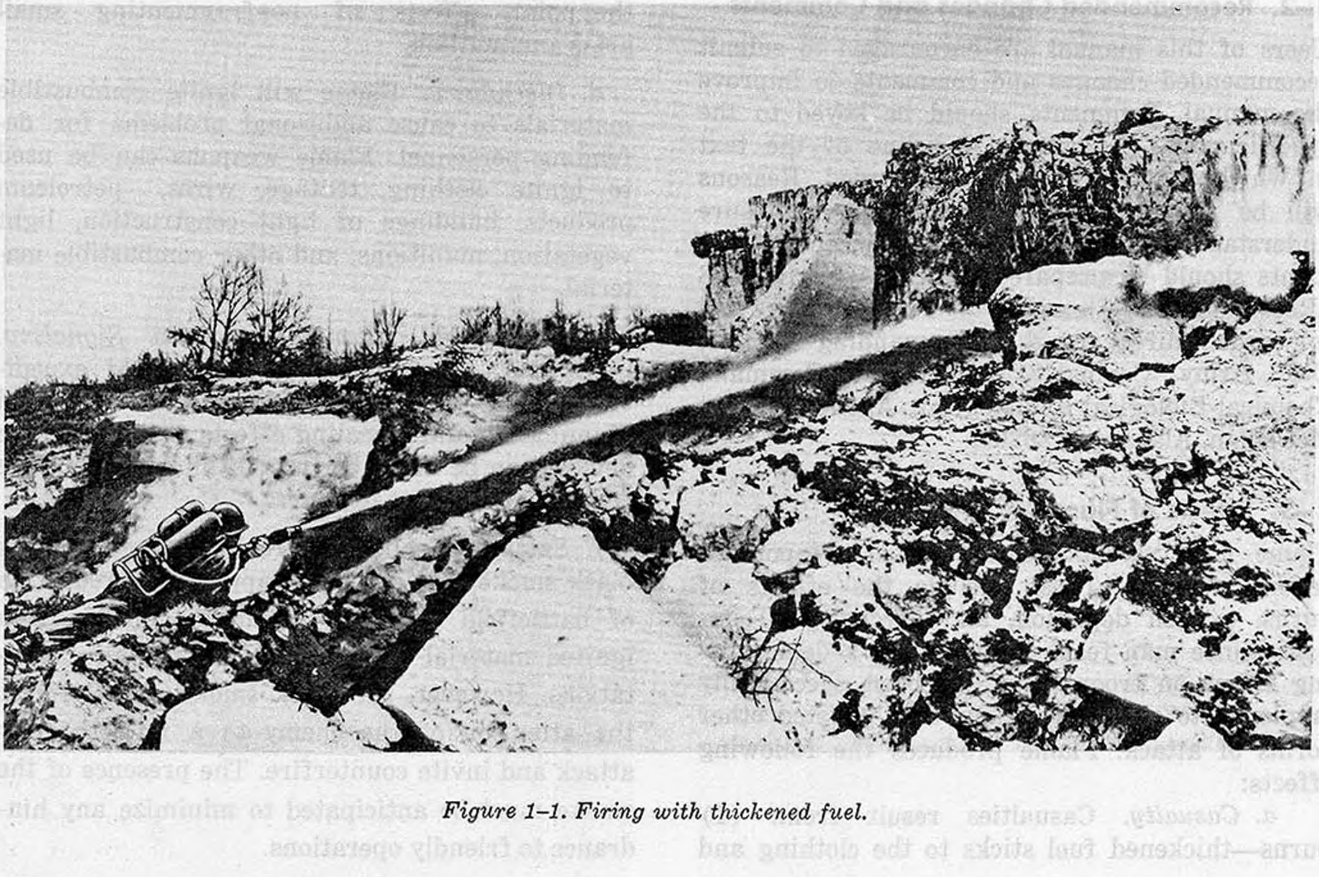


Figure 1-1. Firing with thickened fuel.

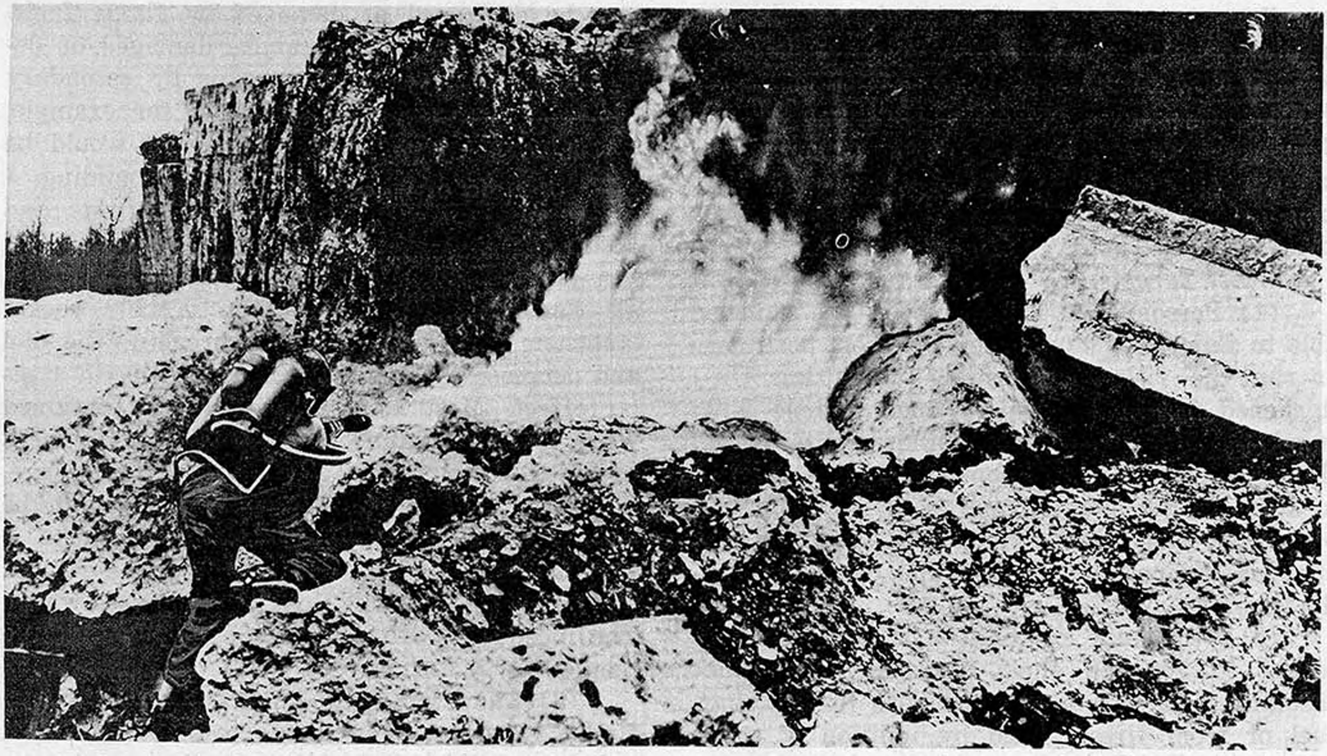


Figure 1–2. Firing with unthickened fuel.

Table 1–1. Flame Targets and Selection of Flame Weapons and Fuel for Firing Against Specific Targets[1]

Target	Flamethrower		XM202 Rocket Launcher
	Thickened fuel	Unthickened fuel[2]	
Pillboxes, bunkers, covered foxholes, and fortifications having small gun ports:			
Ventilated	Excellent	Poor	Excellent
Poorly ventilated	Excellent	Excellent	Excellent
Enemy personnel in open foxholes, trenches	Good	Excellent	Good
Enemy personnel in built-up areas	Excellent	Excellent	Excellent
Armored vehicles:			
Open ports, hatches	Excellent	Good	No data available
Engine air intake ports	Poor	Good	No data available
Buttoned up and mobile	Poor	Good	No data available
Supplies, all types, general	Good	Poor	Good
Unarmored vehicles:			
Carrying personnel	Good	Excellent	Excellent
Unoccupied	Good	Poor	Poor
Gun positions	Good	Good	Good
Wires and cables	Good	Good	Good
Small arms ammunition	Good	Good	Good
Suspected enemy positions	Excellent	Excellent	Good to excellent
Sampans and similar watercraft	Excellent	Poor	Good to excellent

[1] Selection of flame fuel is based on tests or judgment factors, whichever is applicable.

[2] Decreased range of unthickened fuel must be considered.

b. Fortifications. Flame is particularly effective in the attack of personnel in shelters such as fortifications. Its effectiveness depends on the size, number and type of apertures, and construction of the fortification. A small fortification may be entirely reduced, but a fortification with more than one internal compartment usually affords comparative safety to the occupants of internal compartments. The flame fuel must actually penetrate a fortification for maximum results. More fuel is required to cause casualties among personnel in well-ventilated fortifications than in poorly ventilated ones of the same size. Casualties in fortifications may result from suffocation because of the consumption of oxygen from the air by the flame or from actual burns of the individuals.

c. Other Targets.

(1) Personnel in open foxholes are vulnerable to flame and must abandon their positions or run the risk of becoming casualties. Unthickened fuel placed on an open foxhole will engulf the occupants in a billowing mass of flame; thickened and pyrophoric fuel will tend to stick to the clothing and skin of the occupants and the area, forcing the occupants to abandon the position or stay and be burned by the flaming fuel.

(2) Occupants of built-up areas can be forced to abandon their positions or become casualties, either from contact with the burning fuel or from fires caused by ignition of combustible materials such as wooden buildings.

(3) Personnel concealed in vegetation can be forced to abandon their positions or become casualties.

(4) Personnel in armored vehicles may become casualties if the burning fuel penetrates the occupied compartments of the vehicles unless they abandon the vehicles. Armored vehicles that are buttoned up and moving are not good targets for flame, since the burning fuel must penetrate the openings of the vehicles to be effective and burning fuel will not ignite the tracks of moving armored vehicles. Incendiary devices attached to or penetrating the openings of armored vehicles can be effective in disabling the vehicles.

(5) Personnel in unarmored vehicles will become casualties or be forced to abandon the vehicles if flaming fuel is placed in them, since any combustible material in or a part of the vehicles may be ignited or damaged.

(6) Gun positions may become untenable if hit with burning fuel or incendiary material; occupants may become casualties and weapons and ammunition may be damaged.

(7) Wires and cables that are covered with combustible material may be damaged by ignition of the coverings from burning flame fuel or fires from flame or incendiary devices.

(8) Small arms ammunition may be destroyed by use of flame fuels and/or incendiary devices.

(9) General supplies that are combustible may be destroyed or damaged by flame fuels. Noncombustible supplies can be damaged or destroyed by incendiary devices or by secondary fires from combustible materials; for example, supplies stored in a wooden building would be damaged by fires that destroyed the building.

d. Effects of Weather on Flame Fuels and Weapons.

(1) Wind affects the range and accuracy of all flame weapons except the XM202 rocket launcher. A crosswind tends to break up the fuel and decrease the range. A headwind has a similar effect. Most effective results are obtained when the air is calm or when the air movement provides a tailwind and increases the range. Whenever possible, flamethrowers should be positioned to take advantage of this tailwind.

(2) Rain has little effect on flame fuel in flight. Flame fuel will float and burn on water. The incendiary effect is less on damp material than on dry material.

(3) Snow has little effect on flame fuel in flight. However, snow tends to smother flame, reducing its incendiary effects in the target area.

(4) High temperatures tend to increase the fuel's incendiary action. Flame fuels in high temperatures may have to be thickened so that they do not burn excessively in flight to the target. Low temperatures decrease the incendiary action and more fuel may be required to ignite combustible materials. Additionally, at low temperatures, flame fuel may have to be made less thick to insure ignition, and the portable flamethrower may require more than one match charge to ignite the fuel. Fuels may require peptizers during mixing to hasten gelling in cold weather. At extremely low temperatures, difficulties arise that can limit the efficient functioning of the weapon and fuels. Specific precautions and procedures must be followed in fuel selection, preparation, storage, and firing. In operation, servicing, and storage of the portable flamethrower during extremely low temperatures, consideration must be given to—

(*a*) Increased brittleness of metal and rubber components (such as the safety head and rubber diaphragm of the pressure regulator).

(*b*) Freezing of moisture condensation in pressure regulator and needle valve assembly.

1–6. Destruction To Prevent Enemy Use

a. General. Materiel subject to capture or abandonment in a combat zone (except medical) is destroyed by the using unit only when, in the judgment of the military commander concerned, destruction is necessary to keep the materiel from falling into enemy hands.

b. Destruction Procedures. Emergency destruction procedures for fuel, fuel ingredients, and flame weapons are given below. Detailed methods of equipment destruction are presented in appropriate technical manuals and bulletins pertaining to specific items of equipment.

(1) Flammable fuels or lubricants may be destroyed by burning or pouring on the ground.

(2) Thickeners may be destroyed by opening the containers and either dumping the contents into water or fire or spreading the contents on the ground.

(3) Portable and mechanized flamethrowers should be destroyed by smashing, burning, puncturing pressure-released (blown) fuel containers, and cutting lines and hoses, or by using incendiary grenades.

(4) XM202 rocket launchers and XM74 rocket clips should be destroyed by burning, demolition, gunfire, or disposal.

CHAPTER 2

GROUND FLAME OPERATIONS

2-1. Principles of Ground Flame Employment

a. General. Ground flame weapons/munitions are employed for both antipersonnel and antimateriel effects. Their principal use in offensive operations is to reduce fortifications, suppress fire, and produce casualties or expose enemy personnel to the fire of other weapons. In defensive operations they are used to complement other weapons in fire plans. They can be used in stability operations to destroy buildings and equipment, clear tunnels, destroy food, clear light vegetation, counter ambushes, illuminate defensive areas, warn of enemy approach, and restrict enemy use of trails and paths.

b. Tactics. Flame assumes great importance in ground warfare against an enemy whose tactics place emphasis on mass in the attack and stubborn, unyielding resistance in the defense. Even in relatively fluid, rapidly changing situations, an enemy may be able to establish excellent defensive fortifications, the reduction of which will require increased use of flame. Flame weapon tactics conform in general to basic infantry and armored principles of fire and maneuver. The tactical use of flame weapons in conventional attacks depends on the effective application of the principles of employment peculiar to the type of weapon being used. The technique of employment of each type of flame weapon is different because of the difference in its characterisitcs. Both portable and mechanized flamethrowers, though mainly attack weapons, can be used in the defense. The mechanized flamethrower is more effective than the portable flamethrower in defensive situations because of its greater range. Flame field expedients are used primarily in the defense. The XM202 rocket launcher can be used in both offensive and defensive roles because of its light weight, great range, and minimal service requirement. The decision to use flamethrowers, flame field expedients, or rocket launchers is based upon their availability and comparative effectiveness for the particular mission. In planning the attack, the commander considers the use of flame as a part of his plan for fire support. Defensively, flame weapons may be used in the coordinated plan for fires and in support of the counterattack. Flame can often be used to blunt and disrupt mass enemy attacks, but the disadvantages of flame in both defensive and offensive operations must be considered. Careful planning and coordination are needed for maximum benefit from the use of flame in the attack or defense.

c. Ground Flame Munitions and Equipment. Portable flamethrowers, mechanized flamethrowers, flame field expedients, and rocket launchers can be used to provide flame support in the offense or defense.

(1) Portable flamethrowers are TOE equipment authorized on the basis of one per infantry rifle platoon. These weapons are used by infantrymen trained to fire them as a secondary weapon. Two men per rifle squad should fire for qualification, and the remaining men should fire for familiarization. See appendix B for familiarization and qualification firing courses.

(2) The main armament for the Army standard mechanized flamethrower is the M10-8 flame unit. This flame weapon system is mounted in a modified M113A1 armored personnel carrier (APC) to produce the M132A1 self-propelled flamethrower. Another mechanized flamethrower, presently used by the Marine Corps, is the M67A1 flame tank. This flame weapon system consists of the M7A1-6 main armament mechanized flamethrower mounted in a modified M48A2 main battle tank. Mechanized flamethrowers are manned by personnel specially trained to operate them as a primary duty. The crewmen must be capable of firing flame guns and mechineguns as well as driving the vehicle. See appendix C for mechanized flame gunnery courses.

(3) Servicing of both portable and mechanized flamethrowers includes pressurization of the pressure containers and filling of the fuel

tanks. Both portable and mechanized flamethrowers are serviced with truck-mounted or tracked-vehicle mounted service units. Additionally, portable flamethrowers can be pressurized with portable compressors.

(4) Infantrymen are trained in the construction, installation, and use of flame field expedients. As a general rule, at least one man in each squad should receive specialized training on flame field expedients.

(5) The XM202 rocket launcher is authorized on the same basis as the portable flamethrower. At least two men in each platoon authorized the rocket launcher should be trained to fire the weapon. Servicing requires normal operator maintenance and resupply of ammunition.

(6) In addition to the flame munitions discussed above, incendiary grenades can be used to damage or destroy materiel and to ignite the flame fuel of flame field expedients.

2-2. Use of Flame in the Offense

a. General. Flame has many qualifications as an offensive assault weapon. Its effects are demoralizing, casualty-producing, and incendiary; and it has good searching capability through its splattering action. When combined with infantry, tanks, and supporting fires, flame contributes greatly to the accomplishment of the mission. It is particularly effective when combined with infantry fires during the last stages of the assault. Flame weapons can be decisive against an enemy lacking any tank or fire support other than automatic weapons. The limitations of the portable flamethrower stem directly from its range, fuel capacity, and weight. Terrain may limit the use of mechanized flamethrowers and rocket launchers. The doctrine prescribed in FM 7-11 for the offense and defense is applicable to flame weapons.

b. Attack Planning. Plans should be as simple and direct as possible. The following basic principles of employment are applicable in planning for the use of flame weapons in the attack:

(1) *Organization.* As assault weapons, flamethrowers and XM202 rocket launchers must be readily available to the unit requiring them. In daylight attacks, flame teams may be formed by using either the portable flamethrower or the rocket launcher within the rifle platoons or squads. Mechanized flame sections may be attached to battalions or companies. For the team to be effective, personnel using these weapons must be trained in their capabilities and limitations and must be further trained as a part of the team. Operations involving the portable flamethrower are coordinated at company level. Portable flamethrowers must be refueled and reserviced at battalion level, where compressors and service kits are available. Rocket launchers and sufficient ammunition may be carried by the infantry platoons or company or may be held in reserve at battalion level.

(2) *Intelligence.* Intelligence information, such as the size and nature of the objective and the terrain as well as the tenacity and disposition of the enemy, enables the commander to determine how much flame is required and what type of weapon is required to accomplish his mission.

(3) *Reconnaissance.* As with other weapons, a proper reconnaissance is a must for successful employment of flame weapons. The target and any element supporting it must be located; a route of approach that offers protection from enemy fire must be selected; the amount of flame required, together with the necessity for demolition and breaching support, also must be determined. For mechanized flame vehicles, reconnaissance of the path of advance must consider mines, obstacles, and the trafficability of soil or terrain. Much time can be saved if the commander of the supported unit understands the characteristics and capabilities of mechanized flamethrowers sufficiently well to carry out a preliminary reconnaissance for these vehicles. Time can also be saved if the commander of the mechanized flamethrowers moves with the forward unit commander so that he can complete his reconnaissance while the flame vehicles are coming up. Normally, the flame vehicles remain in reserve until a target is found for them. They can be committed to action without a thorough reconnaissance, but this risk must be evaluated on the basis of the existing situation and the necessity for expedited action. The XM202 rocket launcher can be employed without a thorough reconnaissance if the restrictions as to the rear danger zone and the minimum safe range are observed.

(4) *Isolation of the target.* When the reconnaissance is completed and the target is selected, it is necessary to isolate the target. Since the fire and smoke of the flame weapon will attract fire from enemy supporting positions, the area of flame attack should be isolated from observation and fire whenever possible. This isolation may be accomplished by the use of smoke to reduce observation by enemy positions most likely to interfere. Artillery and mortars can be used to neutralize enemy positions on the flanks and in

the rear. Small arms and automatic weapons fire can be used to assist in isolation of the target.

(5) *Fire support.* Because flame weapons are primarily close combat weapons, the operator and the weapons are vulnerable to many types of enemy fire. It is essential that adequate supporting fire be provided to neutralize any enemy positions that might interfere with the flame weapon engaging the target. Rifle, machinegun, tank, mortar, and artillery fire can be used to support a flame attack. Provisions must be made for lifting the supporting fire if necessary as the flamethrower(s) and flame teams reach the target. Mechanized flamethrowers conduct their final assault with the infantry element to assure mutual support between the flamethrower(s) and infantry element in overcoming the enemy position. The supporting fires must be carefully controlled; provisions for radio, pyrotechnic, and other means of control must be included in the attack plan. Before the attack, riflemen and machinegunners are assigned primary and secondary targets of known and suspected enemy positions. Mortars and artillery are assigned targets. Smoke can be used to screen enemy positions that cannot be temporarily neutralized by fire, but care must be exercised that the smoke does not obscure the target of the flamethrower operator.

(6) *Use of sufficient flame.* The number of flame weapons to be used depends on a number of factors; for example, the size and nature of the objective, the terrain, and the morale and physical condition of the enemy. Piecemeal use of flamethrowers should be avoided. The enemy should be made to feel that unless he surrenders or withdraws immediately he will be burned to death. Within control capabilities for coordination of flame weapons supporting the maneuver force, the more flame that can be placed on suitable targets, the greater the success of the attack. The attack should be pressed boldly. Supporting fires must lift or shift as necessary to allow flame weapons to close with the enemy. These fires should continue on enemy supporting positions.

(7) *Followup with infantry.* The enemy seldom fights at his best when he is caught in a flame attack. He usually does one of three things: surrenders, runs, or hides under cover. If he runs before the arrival of the flame, he may return to his position when the attack is over, even though the flame fuel is still burning on the ground. Enemy positions in the flame attack area may hold their fire until the flame attack is over. It is essential therefore that infantry supported by a flame attack follow it closely and quickly before the enemy can reman his position or reorganize his defenses. Friendly infantry must and can enter the area while flame is still burning on the ground. Troops must be given training in following a flame attack closely and dashing through flame on the ground. Surprise and shock must be exploited to the fullest extent. Success in any tactical operation depends largely on the timing and coordination between the flame teams and the unit with which they are operating.

(8) *Manuever forces or fires beyond the objective.* Since flame weapons are primarily short-range weapons, the enemy may be able to withdraw in the face of the flame attack. To prevent this withdrawal, provision must be made for maneuver forces or fires beyond the objective. The maneuver force may consist of an infantry unit deployed on the flank. If the maneuver is accomplished in armored carriers, the firepower of the vehicles can be used. If the vehicles are in position before the flame attack, they can assist the attack itself. Tanks can also be used to provide fires beyond the objective. Artillery and mortar fire can be planned and used in terrain where the movement of a maneuver force is not possible. To be effective, the maneuver force or fire beyond the objective must be ready at the time the flame attack begins and before the enemy has an opportunity to move out of his position.

(9) *Reorganization and resupply.* Flamethrowers carry a limited amount of fuel; thus plans must be made for resupply and refueling. Discharged portable flamethrowers are replaced or reserviced at battalion level, where control is exercised over organic servicing equipment and additional portable flamethrowers from other companies in the battalion. Further support and assistance may be provided by brigade or division. After mechanized flamethrowers have expended their fuel, they are returned rapidly to a predetermined refueling point, which is in the most forward area not exposed to direct enemy fire, where they are serviced by organic equipment and returned to action as soon as possible. Fuel resupply is provided from the division support command. In addition to the clip of XM74 ammunition loaded in an XM202 rocket launcher, an assistant gunner can carry two extra clips. Resupply of ammunition will be handled through normal class V channels. Clips of XM74

ammunition can be resupplied along with other types of ammunition.

c. Teamwork and Security. Flame teams and supported units must develop perfect teamwork. The flame weapon must provide accurate direct fire against resistance holding up the supported unit. The supported unit must provide close-in security for the flame weapon and flame team during the approach, attack, and withdrawal.

d. Advance Preparations. Portable flamethrowers are normally kept by rifle units in preparation for the attack. Mechanized flamethrowers are normally kept in readiness at a convenient point in the battalion area until a suitable target is encountered. The XM202 rocket launcher may be held in reserve or employed with leading elements.

e. Rehearsals. Time should be made available for rehearsals for flame attack, particularly in a stabilized situation. Rehearsals should be conducted on ground similar to the terrain to be traversed and against a point resembling the objective. If the attack is to be made at night, rehearsals should be conducted at night.

2–3. Preparation for the Attack

a. General. While units are in the assembly area, flame weapons are given a thorough equipment check to insure their serviceability. In the assembly area, mechanized flame sections normally join the unit to which they are attached.

b. Orders and Instructions. When flame weapons are employed with a maneuver force, orders and instructions should include—

(1) Attachment of mechanized flame elements.

(2) The mission to be accomplished by the flame weapons and the method of attack to be used by mechanized flame elements.

(3) Positive security measures for the close-in protection of flame teams.

(4) The measures to be taken to insure rapid and timely resupply.

(5) The location of the refueling and pressurizing point.

(6) Selection of flame fire line.

(7) Instructions to the assault forces following the flame weapons.

c. Troop Leading Procedure. The employment of flame weapons with a maneuver force does not alter normal troop leading procedures for the offense or defense. Aspects applicable to combat flame operations follow:

(1) *Tentative plan of attack.* The supported unit leader will issue a warning order to alert attachments as well as his own unit of an impending operation. This tentative plan is based on information received in the attack order, a map reconnaissance, knowledge of similar terrain, and an estimate of the situation. It includes the integrated use of flame weapons.

(2) *Movement of mechanized flame element.* If the mechanized flame element leader is not already with the maneuver force, arrangements are made for him to join the team in the assembly area. He must be informed of the tentative plan of attack as soon as possible.

(3) *Plans for issuing the order.* The employment of flame weapons does not affect arrangements for the time and place the attack order is to be issued.

(4) *Coordination.* If mechanized flame elements are attached, their leaders should be contacted immediately so that they can accomplish their own necessary steps of the troop leading procedure. Plans for the use of flame should be exchanged with adjacent unit leaders.

(5) *Reconnaissance.* The commander of the supported unit plans his reconnaissance with the mechanized flame element leader. When time permits, they make a joint reconnaissance; otherwise, the flame element leader makes a separate reconnaissance and submits his recommendations for the employment of his weapons to the supported unit commander before the attack order is issued.

(6) *Other.* The other steps of the troop leading procedure (complete plan, issuance of attack order, and supervision) remain unaltered.

2–4. Method of Attack

a. Portable flamethrowers are normally employed with assault rifle squads or as directed in the platoon attack order. The XM202 rocket launcher can be used as an assault weapon or as a support weapon. Mechanized flamethrowers, like tanks, are normally employed with infantry, except that they support by machinegun fire and flame. Maximum shock effect from the use of mechanized flamethrowers can be obtained by assaulting the objective while the flame is still burning on the ground. It is highly desirable to employ mechanized flamethrowers with tanks to provide tank protection to the flamethrowers and to achieve surprise and deception. When the enemy detects the mechanized flamethrowers, he will use all available means to neutralize or destroy them before they come within effective range.

b. Mechanized flamethrowers normally flame the objective in advance of the infantry and are used first when both portable and mechanized flame weapons are used against the same objective.

2-5. The Attack

a. Movement to the Line of Departure. Portable flamethrower gunners may cross the line of departure by any one or any combination of the following:

(1) Stealth during reduced visibility and infiltrating to the final coordination line.

(2) Moving under the cover of close-in supporting fire.

(3) Accompanying their squad as part of the assault element.

b. Conduct of Attack. Avenues of approach for mechanized flamethrowers must be over firm ground and terrain that will facilitate maneuver. They are selected to provide cover and concealment from direct fire. Fire superiority in the zone of action of the assault flame team is gained by intense fire of artillery, mortars, flame, and other supporting weapons, combined with intelligent, aggressive maneuver. The portable flame gunners are normally accompanied by extra gunners, security personnel, and/or obstacle-breaching personnel. Flame should be used with the maneuver element. The infantry protects the flame action by providing fire support and security.

c. Control. Control is most reliable when flamethrower gunners have been trained integrally with supported units and when action is preceded by a thorough reconnaissance and detailed planning. Once flaming begins, the problem of control is increased because of the rapid movement of the mechanized flamethrowers and their difficulty in maintaining direction and position in relation to one another and the supported unit. Reliable radio communication between flame vehicles themselves and between flame vehicles and the supported element is essential for control.

d. The Assault. The mechanized flame attack is timed to begin after flame vehicles arrive within effective range of the objective, and before supporting fires are lifted or shifted. Flaming begins at a predetermined fireline. Before and after flaming the target, the flame vehicle machinegun should be used to assist in providing assault fire, unless the flame vehicle has expended all its flame fuel and needs to return to the refueling point for additional fuel. The infantry assault follows the mechanized flame attack quickly and with constant, aggressive pressure. Portable flamethrowers may assault with the rifle squads, assault alone under cover of close-in direct fire, or assault by stealth.

e. Reorganization.

(1) Portable flamethrower operators remain on the objective with the unit to which they are attached in order to take part in reorganization and consolidation. Empty flamethrowers should be replaced immediately (from rear to front on a weapon-for-weapon basis) to provide for continuation of the attack. If time and materiel permit, flame field expedients can be emplaced to cover likely avenues of approach to the position.

(2) After mechanized flamethrowers have expended their flame fuel, they should move to and be serviced as rapidly as possible at a predetermined refueling point. Preplanning the servicing of these flamethrowers is a means of insuring that they will be ready either to assist in the reorganization and consolidation on the objective or to continue the attack.

2-6. Use of Flame in the Defense

a. General.

(1) The use of flame weapons/munitions can be a major factor in the successful defense of any position. Flame weapons are particularly effective in the final stages of the enemy assault. The short range of flamethrowers, however, restricts their employment and requires that they be carefully located to obtain the best advantage. The additional range of the rocket launcher provides greater flexibility in its use. Flame field expedients may be used to partly offset these limitations.

(2) The following flame weapons/munitions can be used in the defense: portable and mechanized flamethrowers, XM202 rocket launchers, and flame field expedients. These weapons are integrated into defensive fire plans to supplement or reinforce other fires. Defensive flame fire plans may employ flame weapons uniformly within unit areas, massed at likely avenues of approach against anticipated massed enemy assaults, or may deploy them in reserve blocking positions ready for use in the counterattack. Particular attention is given to the resupply or replacement of empty flame weapons to insure sustained support for the defense.

(3) Flame weapons/munitions are most effective when integrated into the plan for fire

support and the barrier plan. They are used to supplement or reinforce other defensive fires or to defend a small sector not covered by other weapons.

b. Planning. The basic considerations of defense apply to the use of flame.

(1) *Proper use of terrain.* Flamethrowers and rocket launchers are located on key terrain on the perimeter of the rifle platoon defense areas. Flame field expedients may be emplaced in the gaps between platoons, in approaches to the position, or on key terrain forward of the battle position that the defending force does not plan to hold, and in blocking positions in depth.

(2) *Defense in depth.* Because of its limited range, the portable flamethrower can best be employed on the forward edge of the battle area (FEBA); however, flamethrowers organic or attached to reserve units remain with those units to provide depth to the flame defense. Flame field expedients are placed in likely areas of penetration. The use of these expedients is coordinated as outlined in paragraph 6–1. Mechanized flamethrowers, if held in reserve, materially assist during the counterattack phase.

(3) *Mutual support.* Mechanized flame weapons should be assigned final protective fires that will provide mutual support and increase the duration of flame effects as required. Final protective fires for mechanized flamethrowers should be coordinated by the unit commander to insure cover of assault approaches to provide a sustained, determined defense against massed assaults. Portable flamethrowers, because of their mobility and short range, should be prepared to attack and destroy enemy penetrations in a company sector. Flame field expedients should be emplaced so as to provide mutually supporting area coverage rather than isolated bursts of flame. These expedients may be used to fill gaps between indirect fire targets and to force or canalize enemy troops into final protective fires.

(4) *All-round defense.* Alternate and supplementary positions for flamethrowers aid the all-round defense. Flame field expedients may be positioned to protect the flanks and rear of the position.

(5) *The fire plan.* Flame field expedients may be used to supplement the long-range and close defensive fires of mortars and artillery. However, coordination is required to prevent duplication of effort and destruction of the flame field expedients by friendly fires. All types of flame weapons may be used with the final protective fires and with fires within the battle position to limit penetrations and support counterattacks. Flame field expedients may also be used in an internal defense operations to counter ambush, clear underbrush, illuminate defensive areas, serve as warning devices, and inflict casualties on the attacking troops.

(6) *Flexibility.* Flexibility in the use of flame weapons is gained by preparing alternate and supplementary positions, and by using mechanized flame elements.

c. Reinforcement of Obstacles. Natural and artificial obstacles may be reinforced or extended by flame weapons. For example, flame fuel floats and burns on water; thus it may be used on shallow streams to prevent assaulting foot troops from crossing. Flame field expedients can be used as floating flame devices. Care must be exercised in the use of flame weapons or expedients to preclude damage to mines and premature detonation of other flame devices used in protective minefields and/or to preclude destruction of camouflage.

d. Antitank Measures. Armored vehicles may often move safely through flame fuel burning on the ground, provided the area is traversed quickly and the flames are not high enough to be sucked in through vents. Flame fired directly onto a tank, however, may neutralize it by obscuring vision, seeping inside through vents, or setting it on fire. The minimum effect is profound fear and decreased efficiency of the tank crew. Flame field expedients may be located on probable tank approaches.

e. Brush and Forest Fires. Flame weapons must be used carefully to avoid starting brush and forest fires that may hinder the defense. When it is desirable to start fires deliberately, the following factors should be considered:

(1) Danger to friendly troops and installations.

(2) Probable effect on enemy operations.

(3) Effect on friendly observation.

(4) Effect on future friendly operations.

CHAPTER 3

CHEMICAL MECHANIZED FLAME UNITS

3–1. General

a. Organization of Flame Units. Mechanized flame units are combat units designed to provide mechanized flame support to divisional and nondivisional maneuver elements. The units are—

(1) A section-size team (TOE 3–500) composed of three flamethrowers and one flame fuel service unit for support of a battalion or equivalent maneuver force.

(2) A platoon-size team (TOE 3–500) composed of three mechanized flame sections with some organic logistical capability for support of a separate brigade or a division-size maneuver force.

(3) A company (TOE 3–357) composed of four platoons for support of divisional and nondivisional units in a corps force.

b. Flame Section. The basic operating element of mechanized combat flame units is a flame section composed of three M132A1 mechanized flamethrowers and one M4A2 or XM45E1 flamethrower service unit. This element is operational in nature and does not include overhead personnel for its own administrative and logistical support. Flame sections can be combined to form larger organizations to meet expanded support requirements. The combining of these flame sections imposes command, control, and service support requirements of sufficient magnitude to warrant organization of a platoon-size unit. This unit would be composed of three flame sections and would be provided with an organic capability to supply flame fuel ingredients to the flame sections.

c. Support. Except for the preparation of flame fuel, the section- and platoon-size teams must depend on the supported unit or other nonorganic sources for administrative, mess, maintenance, and supply support. In the case of a company-size flame unit, the entire company or any number of its platoons can be attached to any of the divisions or other corps combat units for operations. Appropriate elements of the company headquarters can accompany detached platoons to provide some mess and maintenance support, but the company headquarters will continue to provide administrative and supply support. A company-size flame unit permits a wide variety of possible employment situations throughout the corps zone of operations and offers maximum flexibility in the employment of mechanized flamethrowers.

d. Employment. Mechanized flame units should be employed according to the guidance contained in chapter 4 for maximum effectiveness.

e. Training. The units should be trained with the unit that they are to support.

3–2. Chemical Mechanized Flame Company (TOE 3–357)

a. Mission. The mission of this company is to provide mechanized flame combat support to combat units of a corps.

b. Assignment. The mechanized flame company is normally assigned to corps, but may also be assigned to Headquarters and Headquarters Detachment, Chemical Group, TOE 3–32 or to Headquarters and Headquarters Detachment, Chemical Smoke Generator Battalion, TOE 3–266. The company or its elements may be attached to an infantry, airborne, armored, mechanized infantry, or airmobile division, or to other corps combat units.

c. Capabilities. This unit has the capability to provide mechanized flame support to maneuver units assigned the task of closing with and destroying enemy forces, or to reinforce prepared defensive positions and barriers by employing mechanized flamethrowers in coordination with weapons organic to supported units. Individuals of this unit can engage in effective coordinated defense of the unit area or installation. The company can also provide the following additional support, employing organic equipment on a priority basis, as established by the commander of the supported unit:

(1) Prepare and fill flame field expedients.

(2) Refuel, pressurize, and service portable flamethrowers.

(3) Decontaminate essential areas by burning.

(4) Destroy enemy supplies and equipment by burning.

(5) Assist in clearing minefields and areas by burning vegetation.

d. Organization. This flame unit consists of a headquarters section, a maintenance platoon, and four flame platoons (fig 3–1). The company is capable of employing its self-propelled M132A1 flamethrowers singly or in mass in support of a wide variety of offensive and defensive operations. It is organized to provide mechanized flame support to the combat elements of a corps.

(1) *Headquarters section.* The headquarters section is the command element of the company and is organized along conventional lines. The section contains the normal facilities for command and control of training and mission activities of the company. This section has organic mess, supply, communications, and administrative personnel assigned.

(2) *Maintenance platoon.* The maintenance platoon performs preventive maintenance services and those organizational level repairs authorized in appropriate technical publications. The platoon is organized so that a mobile maintenance team can accompany each flame platoon to the zone of operation of the supported unit, thereby permitting performance of organizational maintenance in close proximity to the area of employment of the flamethrower.

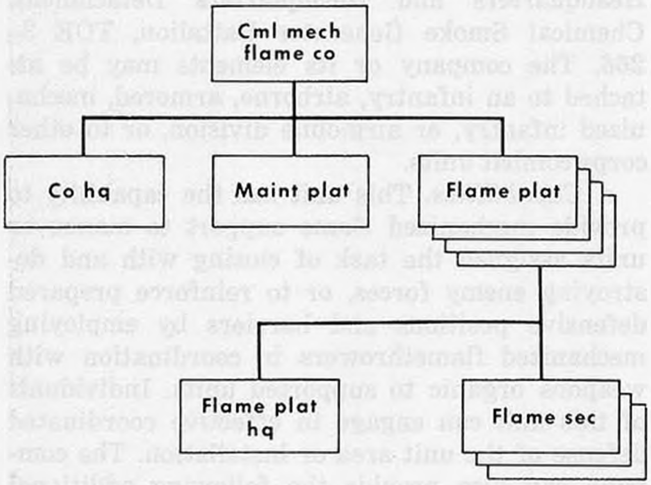


Figure 3–1. Organization of chemical mechanized flame company.

(3) *Flame platoons.* Each flame platoon of the flame company consists of a flame platoon headquarters and three flame sections. The flame platoon headquarters exercises command and supervision of the flame sections and maintains liaison with the supported unit. The flame section, consisting of three mechanized flamethrowers and one flamethrower service unit, is the basic operating unit of the flame company.

3–3. Team NA, Mechanized Flamethrower (TOE 3–500)

This section-size team is designed to provide mechanized flame support to a maneuver force of battalion size. It is a basic operating unit, which employs three mechanized flamethrowers and one flamethrower service unit. This team is capable of mixing fuel and of filling and pressurizing its mechanized flamethrowers. Except for this support, the team is completely dependent upon the supported unit or upon some other cellular teams of appropriate 500-series TOE for mess, administrative, maintenance, and supply support. This cellular team is 100-percent mobile. Under unusual conditions and for short periods of time, the team may employ its flamethrowers singly; however, piecemeal commitment is not desirable since the significant impact of multiple use of flame weapons on the target area cannot be fully exploited. This team is adaptable for providing other chemical combat support such as employment of riot control agents and chemical munitions.

3–4. Team NB, Mechanized Flamethrower (TOE 3–500)

This platoon-size team is organized into three flame sections, each section being equipped with its own flame fuel mixing and service unit. It is designed to support the operations of a division or separate brigade. One section can support a brigade of the division, committing at least three flamethrowers to the supported unit. For a separate brigade, one section can support a battalion. The sections of this team are capable of charging and pressurizing their flamethrowers. These sections have minimal organic capability to supply gasoline and thickener for preparation of flame fuel and are completely dependent upon the supported unit or upon some other external source for mess, administrative, maintenance, and supply support. The team is 100-percent mobile. This team is adaptable for providing other chemical combat support such as employment of riot control agents and chemical munitions.

3-5. Equipment

a. Mechanized flame units are equipped with the required transportation, communications, flame weapons, fuel mixing service units, and other equipment to provide flame support according to the mission of the unit. The mechanized flame company carries a basic load of flame fuel ingredients sufficient to produce two charges (200 gal/charge) of flame fuel per organic mechanized flamethrower.

b. The units are 100- percent mobile in organic transportation. Personnel are authorized weapons to provide them the means of engaging in effective coordinated defense of the unit area or installation.

c. Appropriate communications equipment is required within the mechanized flame company to facilitate command and control during combat operations. The company elements rely on radio for communication within the unit and with the supported unit. The radios of the company must be capable of netting with the radios of the supported unit. A command radio net (FM voice) is used to control tactical operations of the company. Auxiliary FM receivers are provided the company commander and the company command post to permit monitoring the FM net of the supported unit. Messenger or wire communication is used as an alternate means. Wire communications are provided to elements of the company for internal control and administrative purposes, and as backup for command radio net when practicable. Each mechanized flamethrower is also equipped with visual communication means such as pyrotechnics, signaling panels, and flag sets.

CHAPTER 4

MECHANIZED FLAMETHROWERS

Section I. CHARACTERISTICS

4–1. General

a. The mechanized flamethrower has the primary mission of dislodging or destroying personnel in emplacements such as fortified positions, caves, tunnels, underground installations, and buildings that resist assault by other weapons. It has a secondary mission of destroying materiel. Mechanized flamethrowers should attack in conjunction with other ground attack weapons, which exploit the advantages gained by flame and provide the necessary supporting fires to these flamethrowers. Coordination and detailed planning with supported and supporting arms are of primary importance to the successful employment of mechanized flamethrowers.

b. The destructive, casualty-producing, and shock effects of mechanized flame weapons are the same as the corresponding effects of other flame weapons. However, a flame gun mounted in a highly mobile vehicle gives it capabilities and limitations different from those of other flame weapons and dictates differences in its employment. These differences do not alter the fact that all flamethrowers are primarily close-range assault support weapons. In the attack, mechanized flamethrowers are considered complementary, rather than supplementary, to the other fire support means available to the ground commander and must be integrated into the plan for fire support.

4–2. Mechanized Flame Weapons

The following mechanized flamethrowers are available:

a. M67A1 Flame Tank (fig 4–1).

(1) This is an integral-type mechanized flamethrower in which the main armament of the M48A2 tank is replaced by the M7A1–6 mechanized flamethrower (fig 4–2). This flame tank is used by the Marine Corps. The characteristics of the M7A1–6 mechanized flamethrower are listed below.

(*a*) Range ------180 to 200 meters.
(*b*) Fuel capacity --378 gallons.
(*c*) Duration of fire ---60 seconds continuous or a number of short bursts.
(*d*) Mobility ----Same as that of the M48A2 tank.

(2) For technical references on the M7A1–6 flamethrower, see the TM 3–1040–206-series.

b. M132A1 Self-Propelled Flamethrower (fig 4–3).

(1) This Army standard flamethrower consists of flame fuel and air tank units mounted in the cargo compartment of an M113A1 APC and a flame gun cupola that replaces the commander's cupole. A 7.62-mm machinegun is mounted coaxially with the flame gun. The M10–8 main armament mechanized flamethrower is permanently installed in the M113A1 APC.

Characteristics of the M132A1 self-propelled flamethrower are as follows:

(*a*) Range ------150 to 170 meters.
(*b*) Fuel capacity --200 gallons.
(*c*) Duration of fire ---32 seconds continuous or a number of short bursts.
(*d*) Mobility ----Same as that of the M113A1 armored personnel carrier, amphibious and air transportable.

(2) For details on the M10–8 flamethrower, see TM 3–1040–209–12.

4–3. Servicing

Servicing of mechanized flamethrowers is accomplished by units authorized the M4A2 service

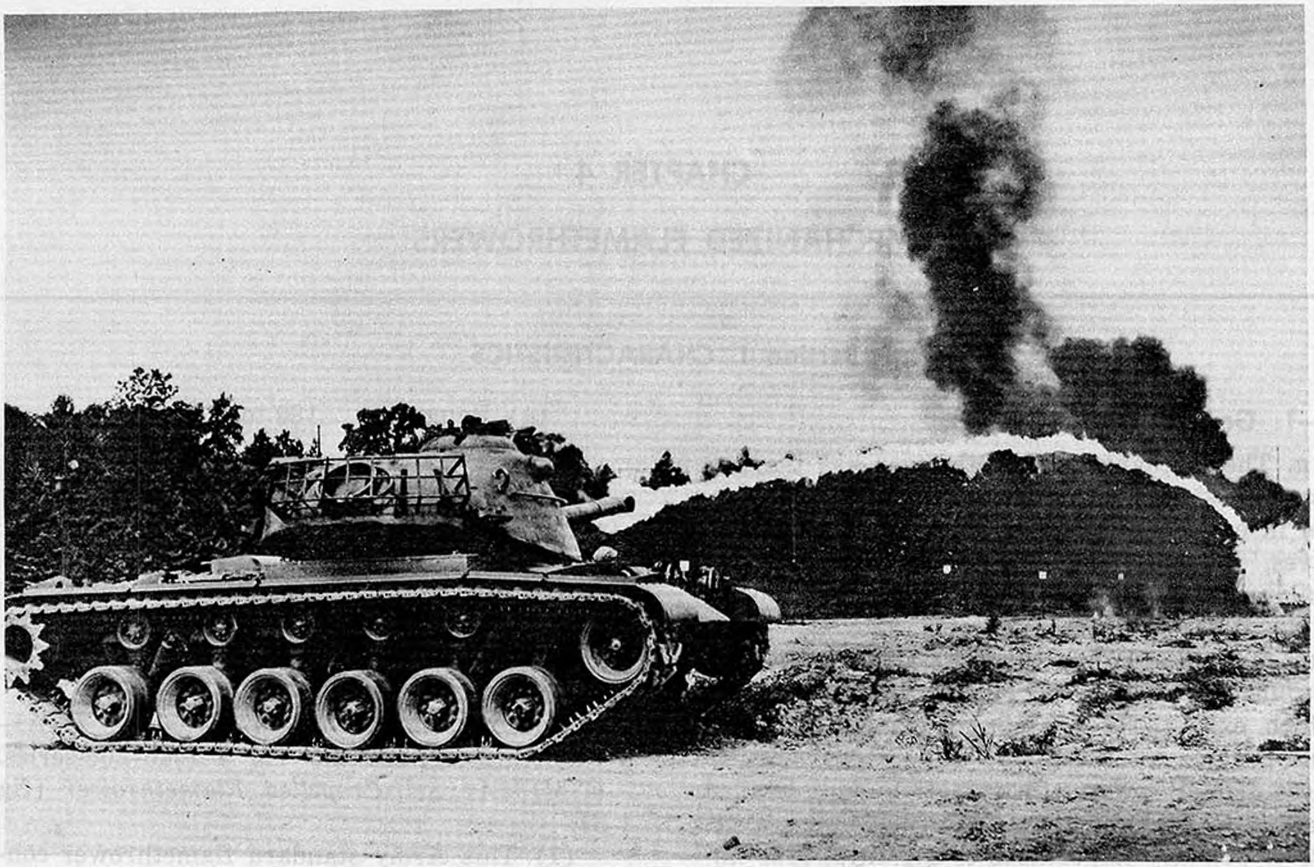


Figure 4–1. M67A1 flame tank.

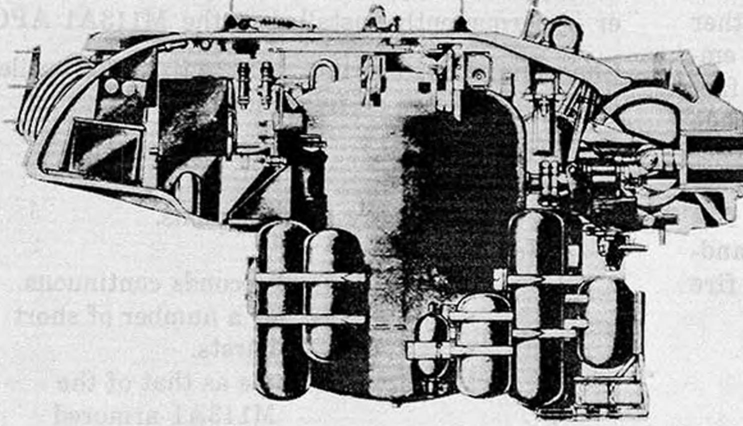


Figure 4–2. M7A1–6 mechanized flamethrower.

unit (fig 4–4) or the XM45E1 service unit (fig 4–5). Each service unit contains a 200-gallon fuel mixing tank and an air compressor. The compressor supplies air at 3,000 pounds per square inch for pressurizing machanized flamethrowers and at 2,000 pounds per square inch for pressurizing portable flamethrowers. The service units mix thickener with gasoline and pump the

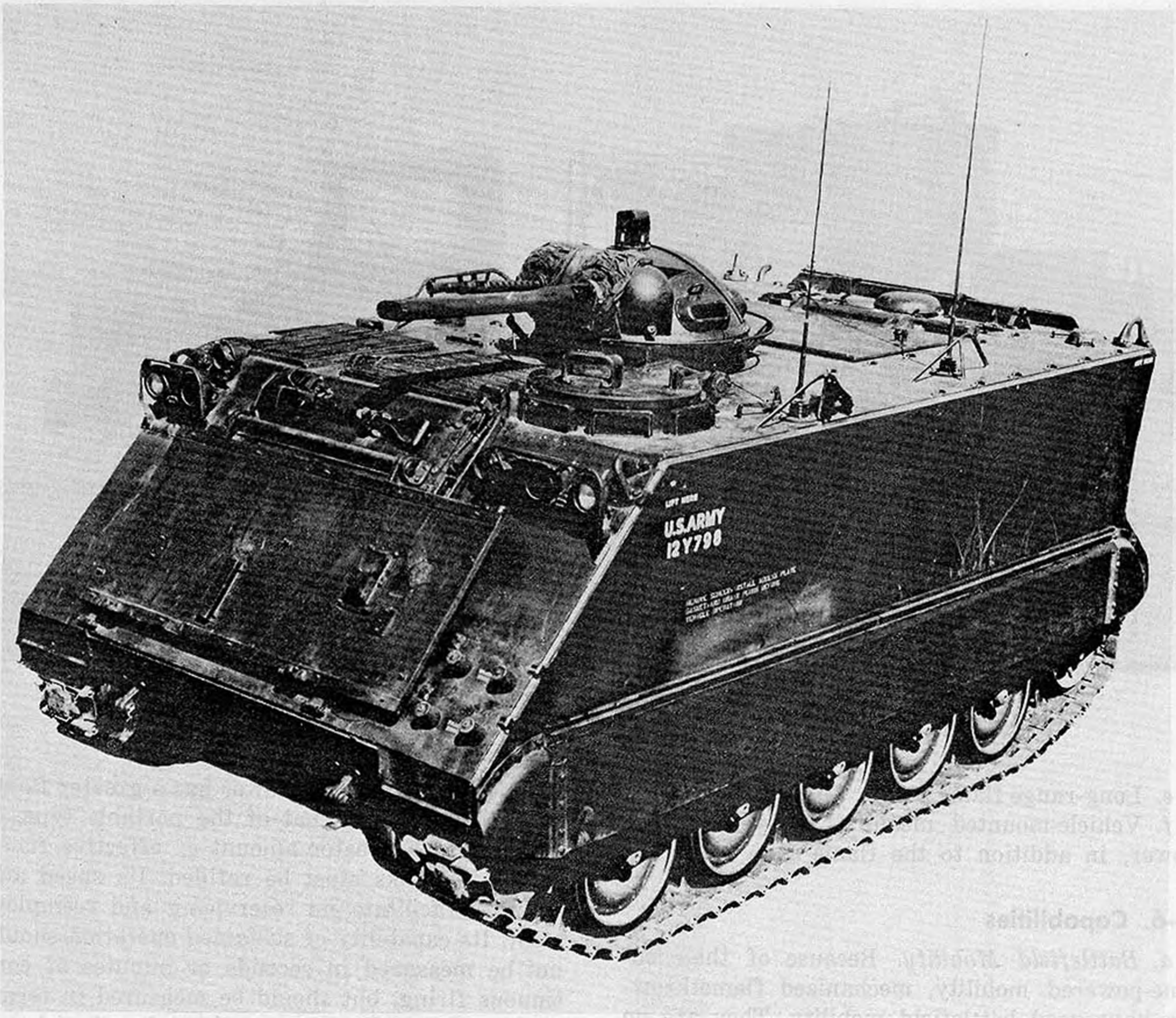


Figure 4–3. M132A1 self-propelled flamethrower.

thickened fuel into flamethrowers, flame field expedients, and (when necessary) firebombs. These units are capable of preheating gasoline for fuel mixing in cold weather. The M4A2 service unit is mounted in the back of a modified 2 1/2-ton 6x6 truck. The XM45E1 service unit, a limited production item, is mounted on a removable pallet installed in the hull of a semiarmored M548 tracked cargo carrier. This tracked-vehicle mounted service unit provides armor protection, mobility of operation over cross-country terrain and improved roads, and amphibious operations on lakes and streams. In addition, the XM-45E1 service unit has two 100-gallon storage tanks for transporting unthickened fuel; this permits a total servicing capacity of 400 gallons. Refer to TM 3–1040–219–12 for additional M4A2 service unit data and to TM 3–1040–256–12 for additional XM45E1 service unit data.

4–4. Gunnery Techniques

Gunnery techniques, training requirements, and the gunner's test for the mechanized flamethrower are contained in appendix C.

4–5. Common Characteristics

Mechanized flamethrowers have the following common characteristics:

a. Engine-powered mobility.

b. Limited armor protection

c. Vehicle-mounted communication facilities.

d. Large flame fuel capacity.

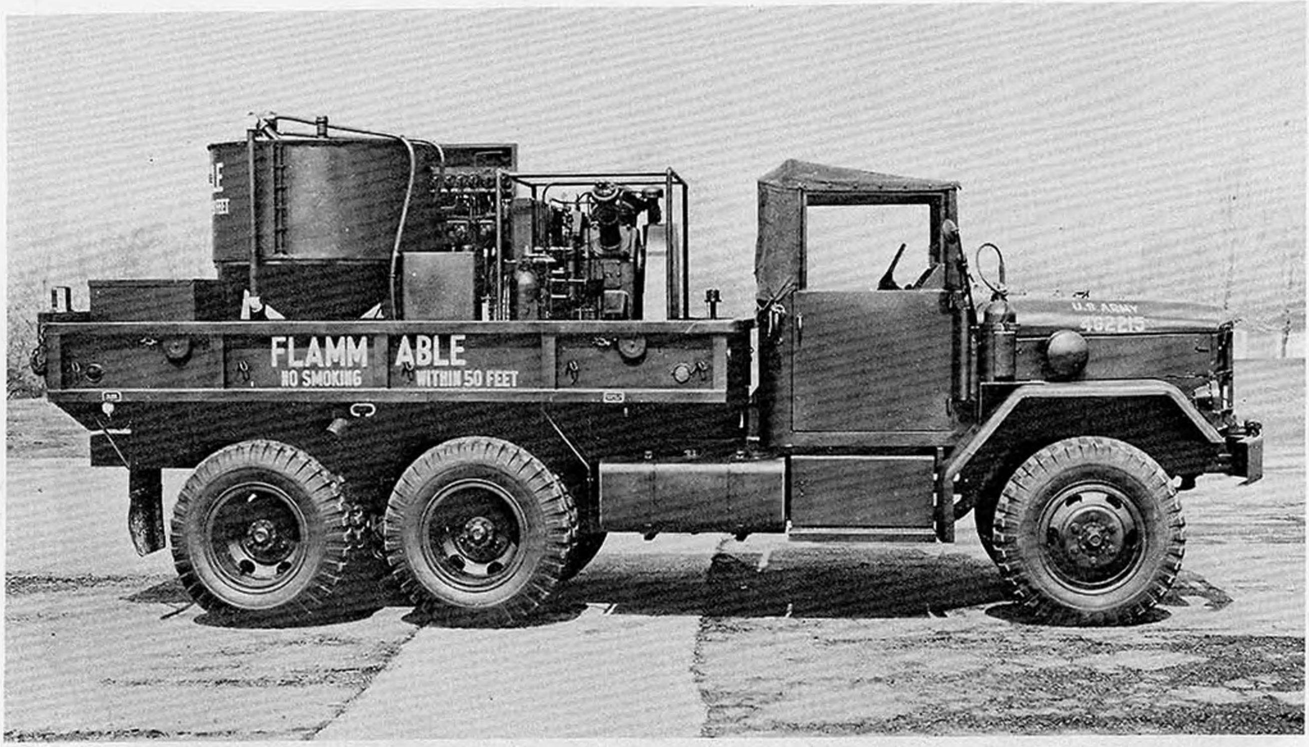


Figure 4-4. M4A2 truck-mounted flamethrower service unit.

e. Long-range flame gun.

f. Vehicle-mounted means of delivering firepower, in addition to the flame gun.

4-6. Capabilities

a. Battlefield Mobility. Because of their engine-powered mobility, mechanized flamethrowers have good battlefield mobility. They are no more sensitive to terrain than are other armored vehicles in the infantry-tank team, and the mechanized flamethrower operators are less vulnerable to artillery and mortar fragmentation and small arms fire than are portable flamethrower operators.

b. Battlefield Survival. Their speed, maneuverability, ability to travel over rough terrain, armor protection, integral automatic weapons, and flame gun range—all provide mechanized flamethrowers with the basic necessities for battlefield survival.

c. Effective Communication. Mechanized flamethrowers have radio communication means that facilitate their control within the infantry-tank team. They are also equipped with visual communication means such as pyrotechnics, signaling panels, and flag sets.

d. Sustained Operation. All flame guns have a high flame fuel consumption rate; but because the mechanized flamethrower has a greater flame fuel capacity than that of the portable type, it can deliver a greater amount of effective flame before its tanks must be refilled. Its speed and mobility facilitate its reservicing and reemployment. Its capability of sustained operation should not be measured in seconds or minutes of continuous firing, but should be measured in terms of the number of effective flame bursts (shots) that it can deliver (4 or 5 bursts of 6 to 8 seconds duration). In other words, each flame burst should be thought of as a "round of ammunition."

e. Comparatively Long-Range Flame Delivery. The range of the flame gun in a mechanized flamethrower can be considered long only in comparison with the range of a portable flamethrower. Its maximum effective range is approximately 150 to 170 meters.

f. Shock Action. Any armored fighting vehicle has shock-producing capabilities. When these are combined with the psychological impact of flame (delivered in conjunction with the fire of the vehicle's automatic weapon during supporting airburst artillery fires and following preparatory support fires), the shock action of a mechanized flame attack can be decisive.

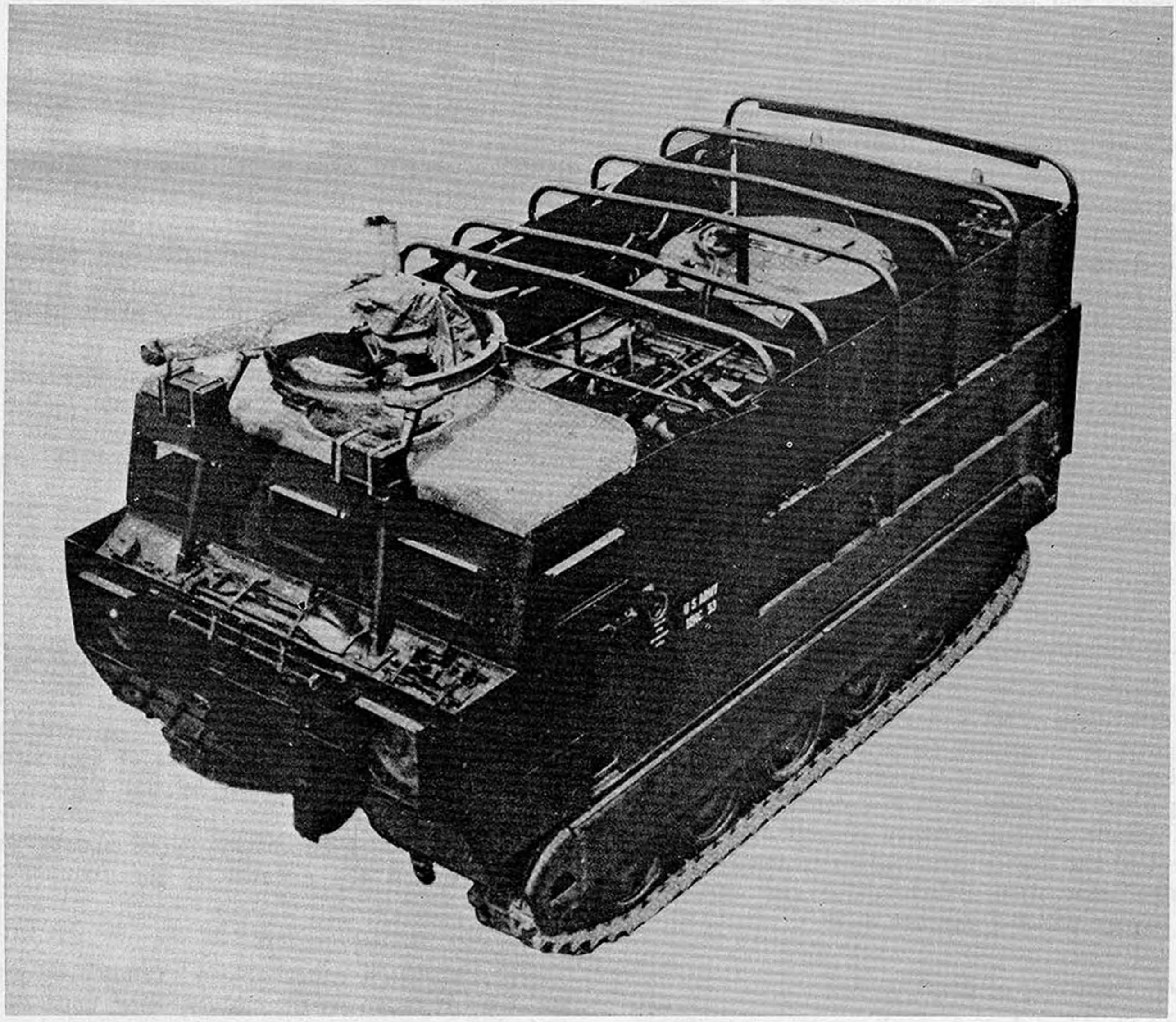


Figure 4–5. XM45E1 tracked-vehicle mounted flamethrower service unit.

4–7. Limitations

a. Limited Range. Although the mechanized flame gun has a greater effective range than that of a portable flame gun, it still falls in the short-range class. Further, the trajectory of the projected flame fuel is readily influenced by wind. These limitations make it necessary that the gunner get near his target and allow for wind velocity and direction. To be most effective, a mechanized flamethrower must have fire support from other weapons during and before the assault so that it can move within flame range of its target. (Flame gunners must be trained to hold their fire until they are within effective range.)

b. Limited Flame Fuel Capacity. The high flame fuel consumption rate of all flamethrowers makes the weapon's capacity a critical factor. The larger its capacity, the greater number of effective flame bursts it can deliver. Commanders must consider this factor in their planning. This limited fuel capacity is the chief reason why mechanized flamethrowers have other vehicular-mounted weapons that remove them from the single-purpose class and enable them to lend additional assault support and to protect themselves. It is also another reason why they must be supported by other weapons so that they can withdraw under covering fires in order to refuel and rejoin the fight. A reservicing plan that takes advantage of mobility of both the flamethrowers and their service units is a necessary part of the plan for their tactical employment. Flame gunners must be trained to use the best type of burst for each target engaged.

c. Sensitivity to Terrain. The battlefield mobility of a mechanized flamethrower is one of its predominant capabilities. Like all vehicles, a mechanized flamethrower is sensitive to terrain. Commanders must understand the vehicle's mobile capabilities over various terrain conditions and, recognizing its limitations, turn terrain to their advantage.

d. Distinctive Silhouette. The flamethrower tank has essentially the same silhouette as that of other tanks until the flame gun is fired. In the case of the M132A1 self-propelled flamethrower, the flame gun and coaxial machinegun projecting from the cupola provide a distinctive appearance in comparison with other APC's, particularly when seen from close, lateral ranges. This vehicle will become a target as soon as it comes within range of enemy weapons, most of which exceed flame gun range. This illustrates the necessity for support from the vehicle's other weapon and other sources. It also emphasizes the desirability of employing mechanized flamethrowers in mass rather than individually.

e. Vulnerability to Antitank Weapons. This is a limitation that is not peculiar to mechanized flamethrowers. Just as the individual soldier must offset this vulnerability by using his own weapons, taking advantage of cover and concealment, and advancing with fire support, so must the mechanized flamethrower. This vulnerability to antitank weapons is an important factor. Obscuring, neutralization, or destruction of antitank weapons must be planned to permit the mechanized flamethrower to advance within effective range of the target.

Section II. EMPLOYMENT IN THE OFFENSE AND DEFENSE

4–8. Employment in the Offense

Mechanized flamethrowers are primarily offensive weapons. They can give effective, close fire support to an assault force as it closes with the enemy. Their offensive capabilities can also be exploited effectively in the defense or during a retrograde movement when short-range engagement of the enemy is necessary to insure a successful operation. Techniques are discussed in paragraphs 4–9 through 4–12.

4–9. Principles of Employment

General principles of employment are given in chapter 2. Those particularly applicable in mechanized flame operations are as follows:

a. Organization. Mechanized flamethrower elements participating in an attack should be trained with the supported unit. If time permits, attacks should be rehearsed on terrain similar to the terrain for which the attack is planned. The rehearsal should employ all or as many of the attack-participating troops as possible. If time does not permit a rehearsal, troops selected should have previously participated in a flame attack. Extensive training must be conducted to familiarize all participating troops with combat flame operations. They must be so conditioned that they will not hesitate to follow up the flame attack. The success of the attack depends on the exploitation by supported ground troops.

b. Reconnaissance. Reconnaissance should be as detailed as time and the enemy situation permit. Particular attention should be given to natural and artificial obstacles that tend to reduce the mobility of the flame vehicles. Routes are planned for each vehicle. Full advantage should be taken of covered routes of approach from the line of departure to the objective. Should the terrain fail to afford a covered or concealed route of approach, smoke should be used to conceal the advance of the flame vehicles.

c. Effective Fire Support.

(1) Although mechanized flamethrowers are support weapons themselves, they must receive support from other weapons. This means that their own fires are included in the commander's plan of supporting fires. Supporting fires from other weapons are requested and planned, with the following missions in mind:

(*a*) Neutralization and/or destruction of antitank weapons on the objective and on neighboring terrain commanding the approaches to the objectives.

(*b*) Obscuring enemy observation until the flamethrowers are within effective flame gun range. Smoke can be effective for this purpose.

(*c*) Protective airburst artillery fire over the mechanized flamethrowers during their advance to their targets.

(*d*) Artillery and mortar fire on enemy personnel flushed out by the flame attack. These missions are planned on routes of withdrawal to the flanks and rear.

(2) In addition to planned and target-of-opportunity fires from supporting weapons, the mechanized flame attack is also supported by the fires of the tanks and infantrymen in the assault force.

(3) Once within range of their targets, flamethrowers go into their fire support role. Their mission is to destroy, or flush out, a dug-in or heavily fortified enemy. Each mechanized flamethrower functions as a member of a team in the coordinated execution of the plan for attack.

d. Commitment in Mass. The number of mechanized flamethrowers to be employed is dictated by the mission and the enemy situation, but is limited by the terrain and available flame weapons. Generally, the largest mechanized flame unit available should be used. Employing mechanized flamethrowers as platoons, or at least sections, will maintain unit integrity as well as mass. When flame support is required but either the number of flame vehicles available or the terrain prohibits employment of a section, employment of mechanized flamethrowers in pairs or individually is justified. Where the number of available mechanized flamethrowers is small (a section, for example), the principle of mass can be applied by integrating these flamethrowers into an assault tank formation. Therefore, in an infantry-tank team attack, mechanized flamethrowers may be most effectively employed when their advance is integrated with that of the tanks of the maneuvering force. This augments the overall mass of the attack and permits the tanks to "shepherd" the flamethrowers to the objective. Mass can also be achieved by providing depth and continuity of flame support. Commitment in waves or rapid rearming, or both, can produce this depth and continuity.

e. Integration Into Assault Elements.

(1) In attacking an objective whose seizure requires reduction of strongly fortified or entrenched positions, mechanized flamethrowers are closely integrated into the assault elements because—

(*a*) They are assault support weapons.

(*b*) They need the fire support that the assault echelon can deliver.

(*c*) The mass of the assault is preserved.

(*d*) The effects of the flame attack can be exploited by the infantry-tank team.

(2) To insure effective integration and coordination within the assault echelon, mechanized flamethrowers are normally attached to rather than placed in general or direct support of the supported assault unit. This control is based on the necessity for unity of effort through unity of command in a tactical action and on the fact that they furnish their support from a short range. Flame units are held under battalion or higher level control until a mission that requires their use by lower units is assigned. Then they are attached to the lowest level necessary to insure coordinated assault teamwork.

f. Rapid and Timely Reservicing. If there is to be depth and continuity to a flame attack, there must be rapid and timely replenishment of flame fuel and pressure tanks. Rarely will depth and continuity not be requirements; therefore, a refueling and repressurizing plan is necessary. This plan should include—

(1) Provisions for servicing equipment and replenishing flame fuel.

(2) Designation of a flamethrower servicing point.

(3) Servicing priorities.

(4) Provisions for its dissemination.

4–10. Targets

a. Personnel. See paragraph 1–5 and table 1–1 for the type of weapons and fuel to use in employing flame against personnel.

b. Materiel. In employing flame against materiel, the objective is to ignite combustibles, explode ammunition, and make unserviceable other equipment and supplies.

4–11. Techniques of Employment

Mechanized flamethrowers are employed in offensive operations when they can be decisively more effective than other type weapons. It is desirable to employ them as part of an infantry-tank-flame team. Their employment parallels the following three methods of attack by the infantry-tank team:

a. Tanks, Mechanized Flamethrowers, and Infantry Attack on the Same Axis. Flame vehicles, supporting infantry units, are integrated into the attack formation. The flame vehicles should be so positioned that they can reach their part of the objective without complicated maneuvering. To avoid slowing tanks and flame vehicles to the rate of march of dismounted infantry, it is frequently desirable that they remain initially near the line of departure and move forward on order to join or precede the infantry assault. In addition, the presence of tanks and flame vehicles in the initial phase of the attack may prevent surprise and may draw fire on the accompanying infantry. The flame vehicles should time their advance so that they can assist the infantry within effective range of the flame weapon.

b. Tanks, Mechanized Flamethrowers, and Infantry Attack on Two Converging Axes. Flame vehicles may accompany tank and infantry elements on one axis or both axes. Should terrain or the possible loss of surprise preclude them from accompanying the infantry, they should remain near the line of departure initially or accompany the tank elements.

c. Tanks and Mechanized Flamethrowers in Support by Fire Only. When tanks and mechanized flamethrowers cannot accompany the infantry units, the tanks may support the action by fire if the range and tactical situation permit. If within effective range of the flame weapon, the mechanized flamethrower can support by flame alone within troop safety limitations.

4–12. Specific Tactical Situations

Using the techniques described in paragraph 4–11, modified to meet the existing situation, mechanized flamethrowers can be used advantageously in the following tactical operations:

a. Attack of a Strongly Fortified Position. The attack and reduction of a fortified area is primarily an infantry mission. The attack of a fortified area is characterized by a number of separate attacks on individual fortifications. An assault team is normally assigned one specific pillbox or fortification to attack, although several objectives of this type may be assigned for successive reduction. If antitank obstacles, wire, and mines do not prevent, mechanized flamethrowers can be used effectively to support the assault team. Flame is directed at embrasures and openings in the fortification to blind the occupants and to cover the advance of demolition parties of the team. Because of its greater range, better protection, and greater flame fuel supply, the mechanized flamethrower is much more effective than the portable flamethrower for this mission, if it is not exposed to direct antimechanized fire. If the position is organized in depth, a reserve of mechanized flamethrowers should be established to pass through and flame the deeper objectives.

b. Attack of a Built-Up Area. The attack of built-up areas such as towns and cities is primarily an infantry mission, with tanks employed in a supporting role. Infantry platoons, supported by tanks and mechanized flamethrowers, are assigned specific limited objectives and leapfrog one another in advancing the attack. Infantry units provide close-in protection for supporting tanks and flame vehicles against tank hunters. Mechanized flamethrowers aid the advance of the team by firing on targets such as buildings, basements, or other structures. Infantry units normally precede the mechanized flamethrowers, indicating specific targets for attack. Consideration must be given to replacing and refueling flame vehicles to make certain that adequate flame capability is maintained throughout the attack.

c. Attack in Heavily Wooded Areas. Mechanized flamethrowers may be employed in clearing the enemy from forests or heavily wooded areas. However, there are limitations to this type of employment. Considerations for the employment of mechanized flamethrowers while attacking in heavily wooded areas are much the same as those for other armored vehicles. Dismounted infantry normally leads the attack in these operations. The density of the forest or wooded area, the number of tree stumps, and the amount of undergrowth are important factors that can limit the usefulness of mechanized flamethrowers. In the initial stages of clearing the perimeter of a forest, flamethrowers are especially useful. Normally, most of the enemy's defensive positions are located along the edge of the woods. As a rule, these are well concealed and difficult to pinpoint. Flamethrowers should be used to flame the general area. Although the enemy may not actually be hit by the flame, the burning undergrowth and resulting smoke may make the area untenable.

d. Attack of a River Line. Where the width of a water obstacle permits, the fire of mechanized flamethrowers can be effectively employed to support an assault crossing. The flamethrowers fire from static positions on the flanks of the crossing and the gaps between units. Flame can be used to destroy enemy defenses on the far bank. The dense clouds of smoke from the burning fuel may help screen the troops carrying out the crossing. The most successful timing for an attack of this type is for the flamethrowers to move forward and commence flaming at the moment the assault boats enter the water. Flame on the water continues to burn but may be crossed by assault boats without damage. Because the M132A1 self-propelled flamethrower is amphibious, it may fire flame bursts while afloat. This capability allows the use of flame in the assault crossing of wide rivers.

e. Attack at Night. Flame employed at night is made more effective by its increased psychological impact. Further, it may temporarily blind enemy troops. If sufficient flame is maintained to the front as the attack progresses, it will provide illumination and prevent the attacking forces from becoming silhouetted by the flame still burning from the rear. Flame may also be used advantageously at night for reconnaissance by fire and decoy tactics.

f. Attack in Jungles. The opportunity to employ mechanized flamethrowers in mass seldom arises during jungle operations. Normal employment is to attach small flamethrower elements to infantry. Employment is the same as for normal operations except as affected by reduced visibility. The planning of the operation must be detailed because of difficulty in control.

g. Attack in Mountainous Terrain. In mountainous terrain, the greatest difficulties are encountered in negotiating the terrain and in resupply. The opportunity to employ flamethrowers in mass seldom arises. Normal employment is to attach small flamethrower elements to infantry units to be used in the reduction of fortifications such as pillboxes and caves.

h. Attack in Riverine Areas. The M132A1 self-propelled flamethrower has amphibious characteristics that allow it to provide mechanized flame support in most riverine areas. This flamethrower can be used to attack fortifications, counter ambushes, and force occupants from small tunnels and cave complexes. See FM 31–75 (Test) for additional information on the use of flame in riverine operations.

4–13. Employment in the Defense

a. Mobile Defense. Although mechanized flamethrowers are primarily offensive weapons, they may also be used to advantage in mobile defense. When so employed, the techniques discussed in paragraphs 4–9 through 4–12 (offense) apply. Mechanized flamethrowers may, however, be employed in a defensive position as a supporting weapon. When so employed, they should be located well forward to cover likely approaches of attack. Flame vehicles must be closely protected by infantry. Routes of withdrawal as well as alternate and supplementary positions should be selected.

b. Area Defense.

(1) Mechanized flamethrowers may be employed on the FEBA to cover avenues of approach. Flame vehicles must be closely protected by friendly forces and dug in wherever possible. Routes of withdrawal to permit refueling, as well as alternate and supplementary positions, must be selected. Mechanized flamethrowers employed on the FEBA may be attached down to company level, depending on the mission.

(2) Another suitable role for the mechanized flamethrower is within the reserve. When mechanized flamethrowers are employed as part of a counterattack force, the techniques discussed in paragraphs 4–9 through 4–12 (offense) apply.

c. Defense of Rear Areas. Mechanized flamethrowers may be effectively employed in the defense of rear areas in a general support role similar to that of other support weapons of the combined arms team. The technique of employment is the same as in other mobile roles. Two or more mechanized flamethrowers should be present with the force operating against guerrillas, infiltrating troops, and airborne units.

d. Special Operations. The principles of employment of mechanized flamethrowers apply to the defensive aspects of special operations. However, the technique of application varies according to the type of operation.

e. Retrograde Operations. The mechanized flamethrower may be used against massed attacks that threaten to overrun a defensive position. It may also be used as a supporting weapon in counterattacks designed to permit friendly forces to disengage and withdraw.

f. Desert Operations. In desert operations the care and cleaning of mechanized flamethrowers is of particular importance. Details on the difficulties of preparing and storing thickened fuels in a hot climate are given in TM 3–366. Although there is a general lack of good cover and concealment, desert terrain is excellent for the employment of mechanized units. Mechanized flamethrowers are, therefore, well suited for employment in these areas since they can maintain the same speeds as tanks and other armored vehicles and are thus able to blend with these vehicles in order to avoid detection as flame weapons. The tactics and techniques of desert operations are discussed in TM 31–25.

g. Operations in Snow and Cold Climate. Mechanized units generally have good mobility over flat to gently rolling snowy terrain. Mechanized flame weapons, tanks, and personnel carriers complement one another as far as ground mobility is concerned, and mechanized flamethrowers can be less readily identified as such when used with other mechanized vehicles. See FM 31–71 for a discussion of flame operations in a cold climate.

CHAPTER 5

PORTABLE FLAME WEAPONS

Section I. INTRODUCTION

5–1. General

There are two different types of portable flame weapons available: the portable flamethrower and the XM202 rocket launcher.

a. Portable Flamethrower. This weapon projects flame fuel from a pressurized container through a nozzle to the target. The projected fuel is normally ignited as it passes through the nozzle of the flame gun. The portable flamethrower is a close-support weapon that can be used to reduce fortifications, suppress fire, and produce casualties.

b. XM202 Rocket Launcher. This four-tube launcher fires a rocket containing a flame agent mixture that ignites on exposure to the air. The rocket warhead is equipped to detonate on impact. This launcher is a close-support weapon for use in neutralizing enemy gun emplacements and fortified positions, and in street and village fighting.

5–2. Employment of Portable Flame Weapons

a. Portable Flamethrowers. This short-range assault weapon is normally employed by infantry elements in the assault of the objective. Because of the vulnerability of the operator and the limited amount of fuel, it is often necessary to employ more than one portable flamethrower with the assault element. Although it is primarily an offensive weapon, the portable flamethrower can also be employed in the defense.

b. XM202 Rocket Launcher. This direct fire weapon has a greater range than that of the portable flamethrower and may be employed in support of other flamethrowers or rocket launchers employed with the assault element. The rocket launcher provides greater flexibility than other flame weapons when employed in both the offense and the defense.

Section II. PORTABLE FLAMETHROWERS

5–3. General

Available portable flamethrowers and their characteristics are as follows:

a. ABC–M9–7 Portable Flamethrower (fig 5–1). This is a lightweight portable flamethrower (procured by Marine Corps only) consisting of an aluminum frame, lightweight alloy fuel tanks, a pressure sphere, and the M7 gun group (fig 5–2).

(1) Weight ______50 pounds loaded.
(2) Range ________40 to 50 meters.
(3) Fuel capacity _4 gallons.
(4) Duration of fire ________5 to 8 seconds of continuous fire, or 3 to 4 short bursts.

b. M9E1–7 Portable Flamethrower (fig 5–3). This limited production item is an improved version of the M9–7 flamethrower. Modifications include an improved air pressure system, a cover assembly that fits on top of the tank group, and a holster for stowing the gun group. Issued with the flamethrower is a supply kit that contains four high-pressure sphere assemblies and two cans (two cylinders per can) of ignition cylinders. For additional information on the M9E1–7 portable flamethrower, see TM 3–1040–257–12.

(1) Weight _______52 pounds loaded.
(2) Range ________45 to 55 meters.
(3) Fuel capacity _4 1/4 gallons.
(4) Duration of fire ________6 seconds of continuous fire, or 3 to 4 short bursts.

c. M2A1–7 Portable Flamethrower (fig 5–4). This flamethrower consists of a steel frame, fuel

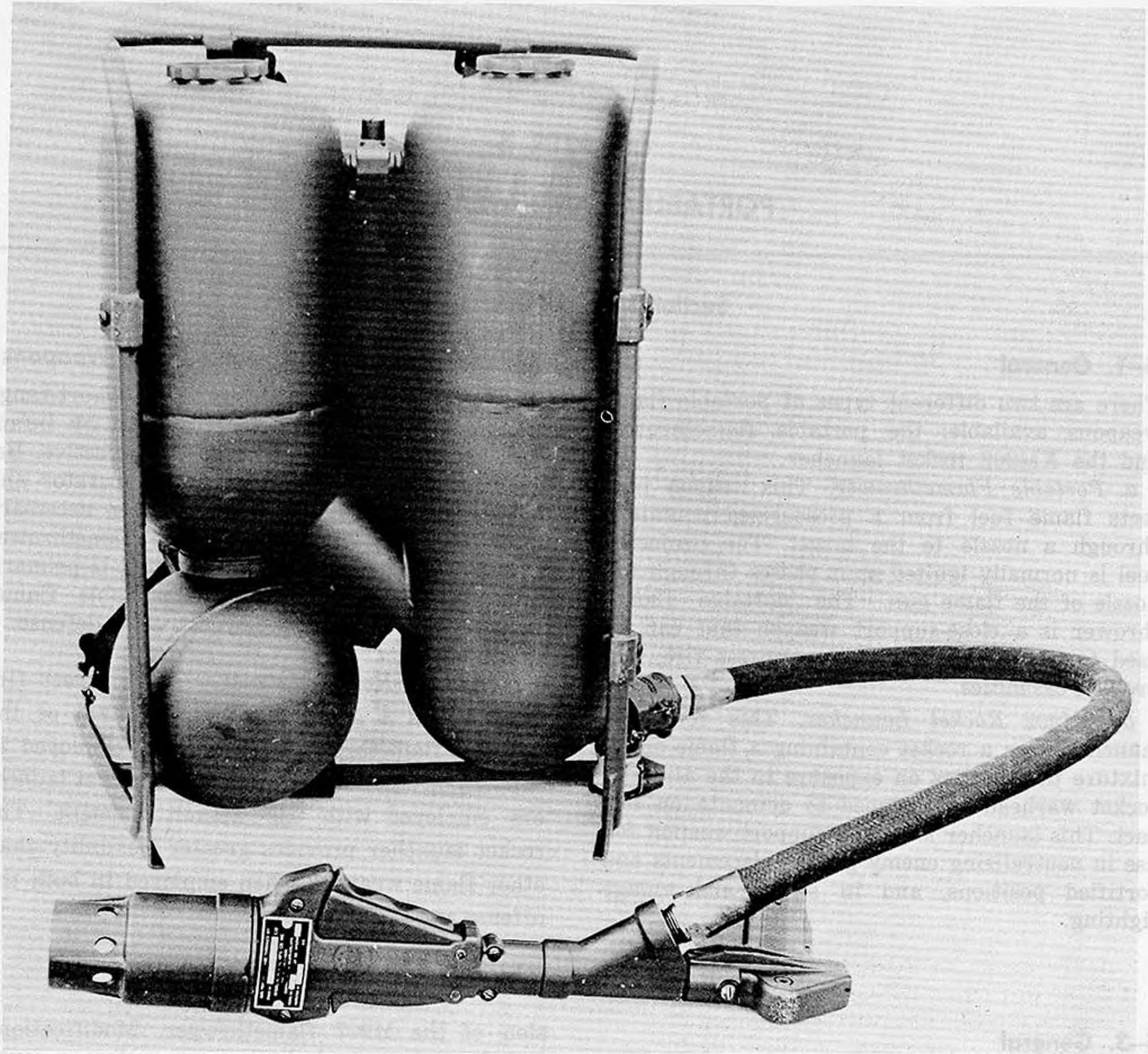


Figure 5–1. ABC–M9–7 portable flamethrower.

tanks, and a pressure tank. It uses the M7 gun group.

(1) Weight ....65 to 69 pounds loaded.
(2) Range ....40 to 50 meters (thickened fuel); 20 to 25 meters (unthickened fuel).
(3) Fuel capacity ..4 1/2 (+) gallons
(4) Duration of fire ....6 to 9 seconds of continuous fire, or 4 to 5 short bursts.

5–4. Servicing

Servicing of portable flamethrowers includes filling the fuel tanks and pressurizing the pressure sphere or tank. Principal items of servicing equipment are compressors and service kits (figs 5–5, 5–6 and 5–7), which are TOE items of the headquarters and headquarters company of units authorized the portable flamethrower. The M4A2 or the XM45E1 service unit may also be used to service portable flamethrowers. Servicing and resupply are a responsibility of the battalion commander, who controls the use of all portable

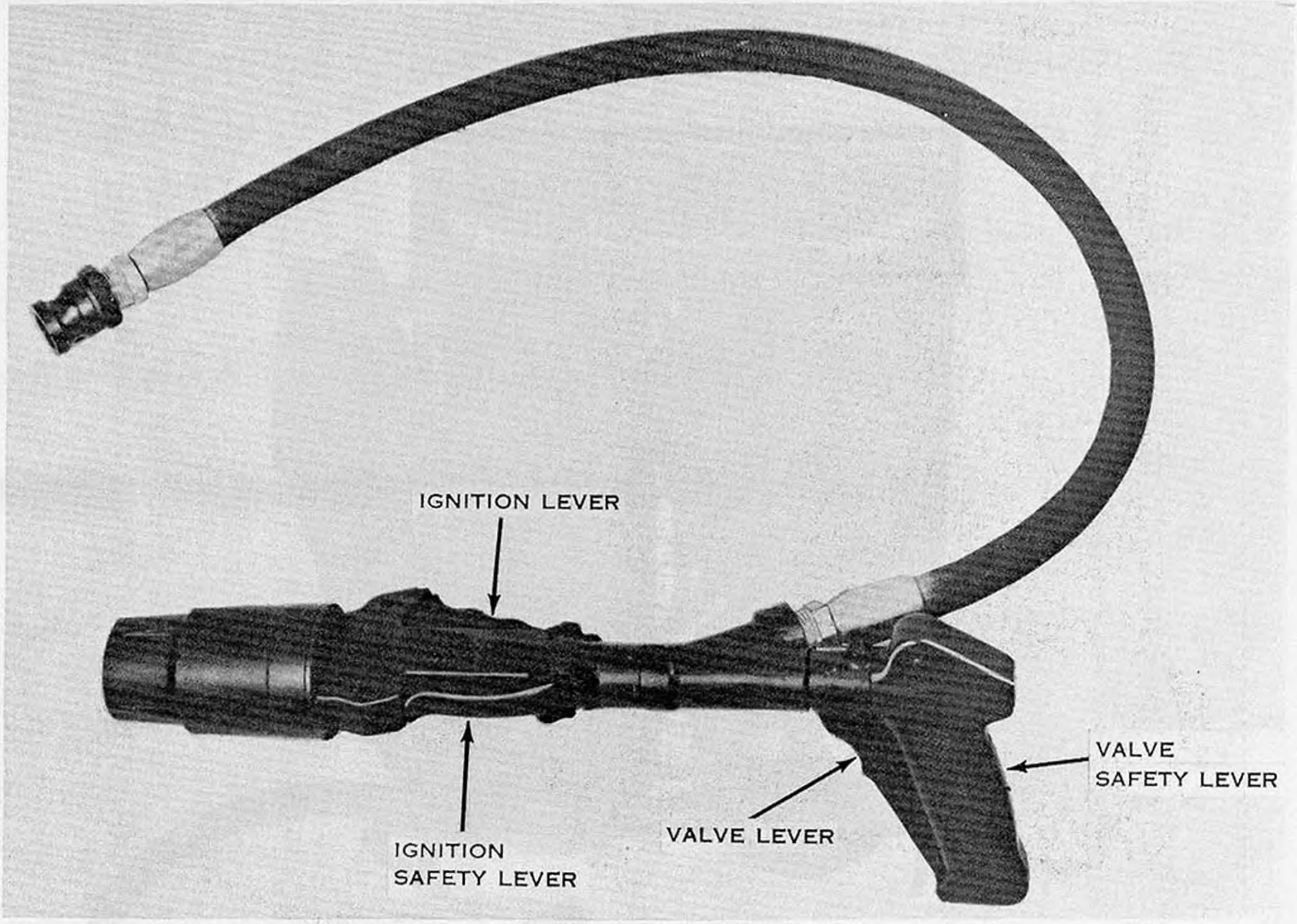


Figure 5-2. M7 flame gun group.

flamethrowers in his command. Replacement of used flamethrowers must be carefully planned to insure resupply of fully serviced flamethrowers from within battalion assets. Battalion headquarters and headquarters company personnel (assisted by flame gunners when necessary) service portable flamethrowers. If available, chemical service personnel (TOE 3-357 and TOE 3-500) can provide this service. Portable flamethrowers can be serviced in approximately 15 minutes (using the AN-M4 compressor), exclusive of thickened fuel preparation; however, they can be serviced in less time by using the M4A2 service unit or compressed air cylinders. Servicing should be accomplished as far forward in the battalion area as practical. Thickened fuel may be prepared locally by hand-mixing procedures (TM 3-366) or by using any fuel service units available in the battalion area. Flame fuels may be provided from the rear area in containers ready for transferring to the flamethrowers as indicated in figure 5-8.

5-5. Gunnery Techniques

Gunnery techniques, training requirements, and the gunner's test for the portable flamethrower are contained in appendix B.

5-6. Capabilities and Limitations

a. Capabilities. The portable flamethrower is a man-portable weapon used primarily to attack fortifications and enemy strongpoints; it is also used in street and jungle fighting. It produces a great demoralizing effect on personnel subjected to attack by this weapon. The projected flame fuel can penetrate small openings and ricochet and splatter from wall to wall, spreading burning fuel over areas not accessible to the point effects of nonfragmenting small arms ammunition. The maximum range of the portable flamethrower is approximately 55 meters (less for unthickened fuel).

b. Limitations. The portable flamethrower has a short range (20 to 50 meters, dependent on

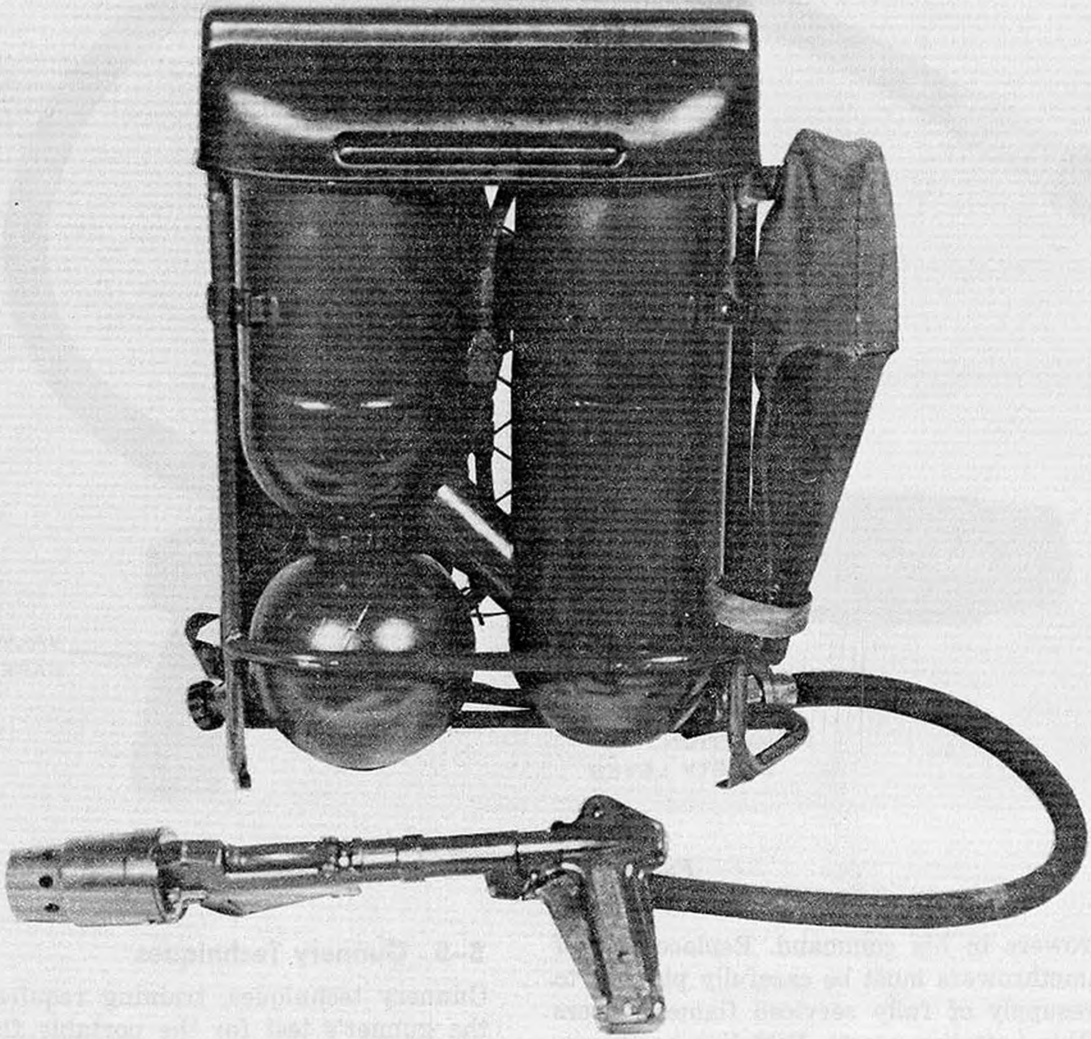


Figure 5-3. M9E1-7 portable flamethrower.

type of fuel) and a limited duration of fire (dependent on type of flamethrower and other limiting factors). Wind, terrain, and type of fuel determine to a great extent its effective range. Employment of heavier models is more limited in rugged terrain and in airborne and mountain operations when flamethrowers must be manpacked.

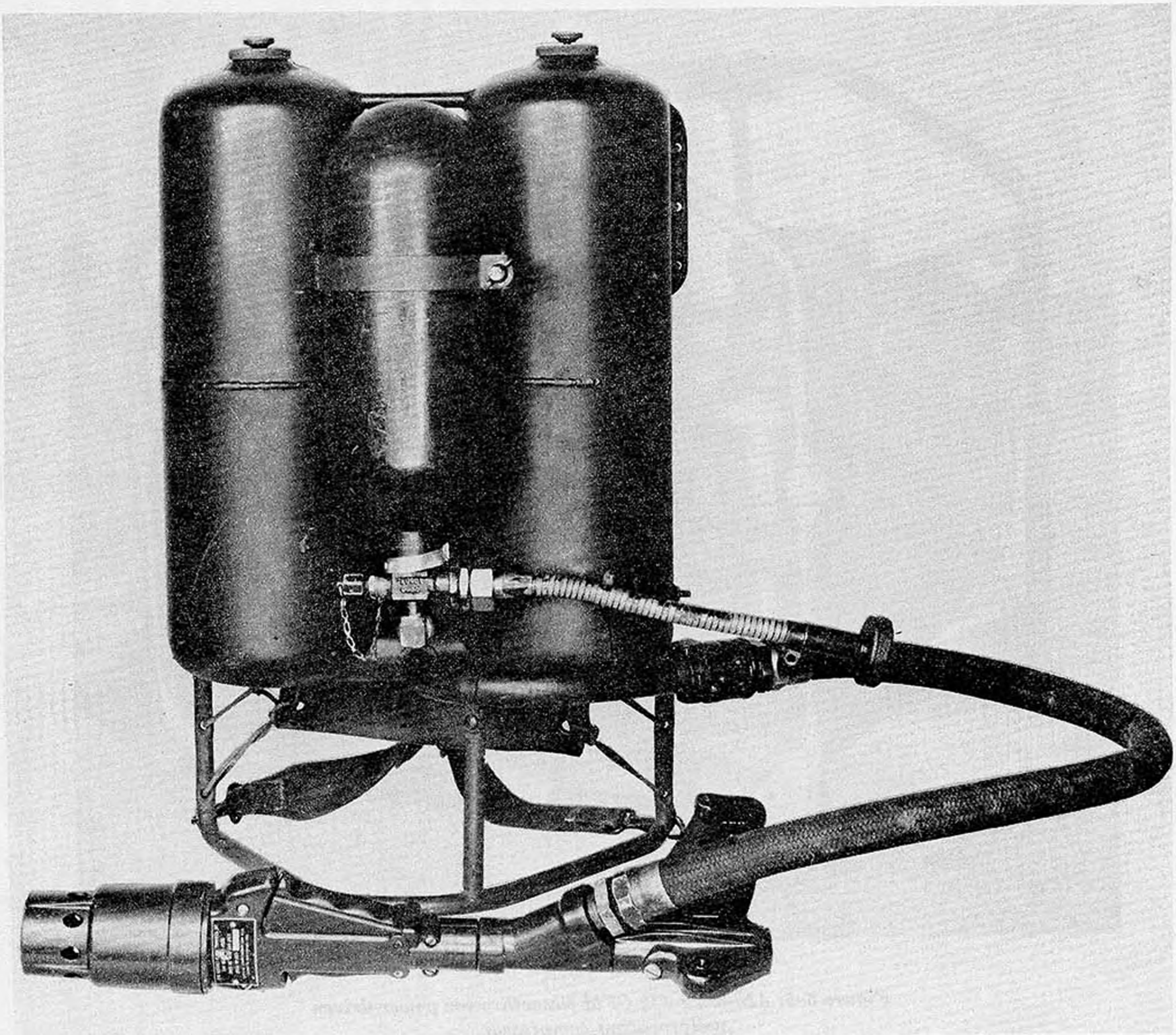


Figure 5–4. M2A1–7 portable flamethrower.

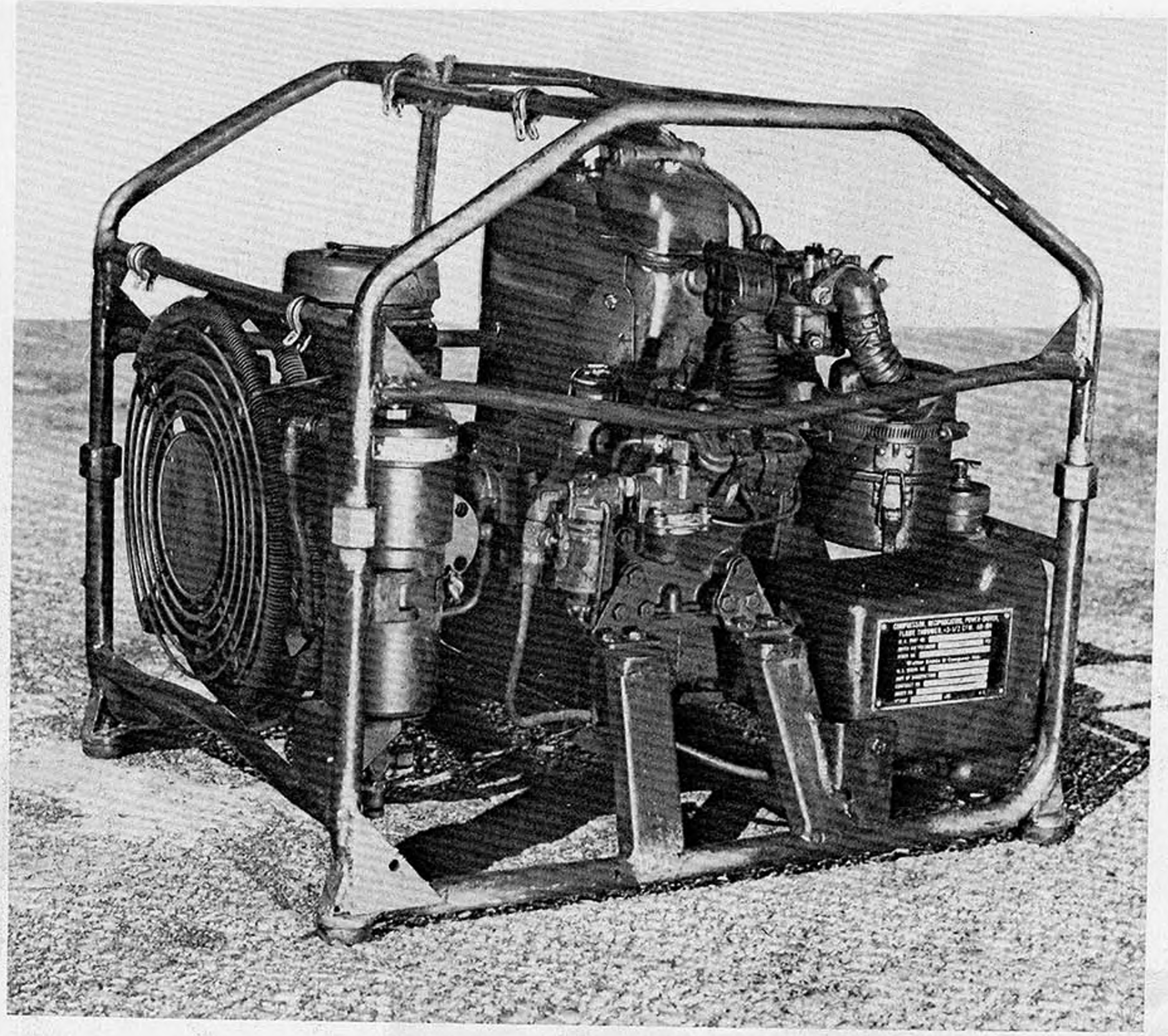


Figure 5-5. AN-M4 3 1/2 CFM flamethrower power-driven reciprocating compressor.

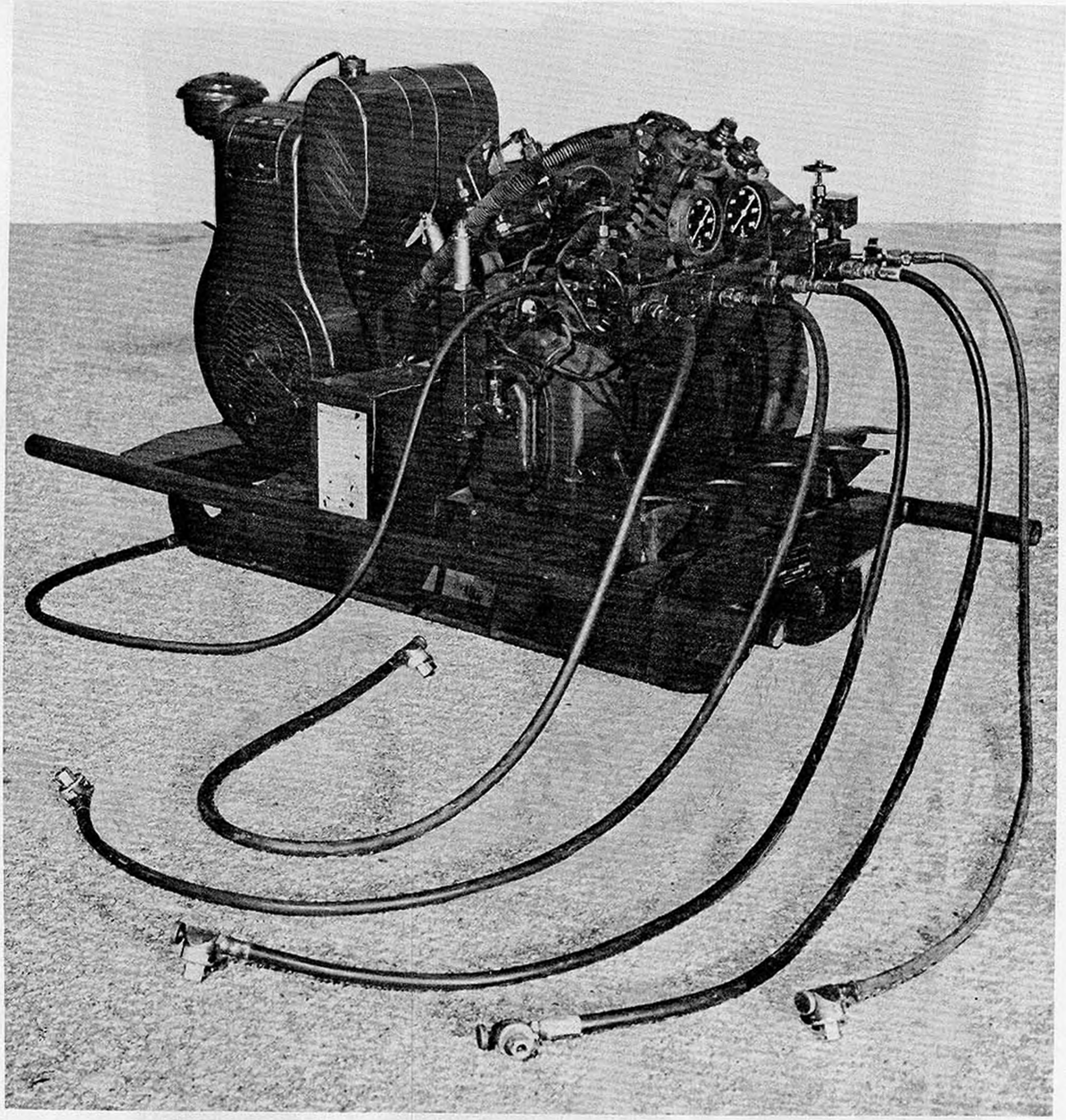


Figure 5–6. M1A1 7 CFM power-driven reciprocating compressor.

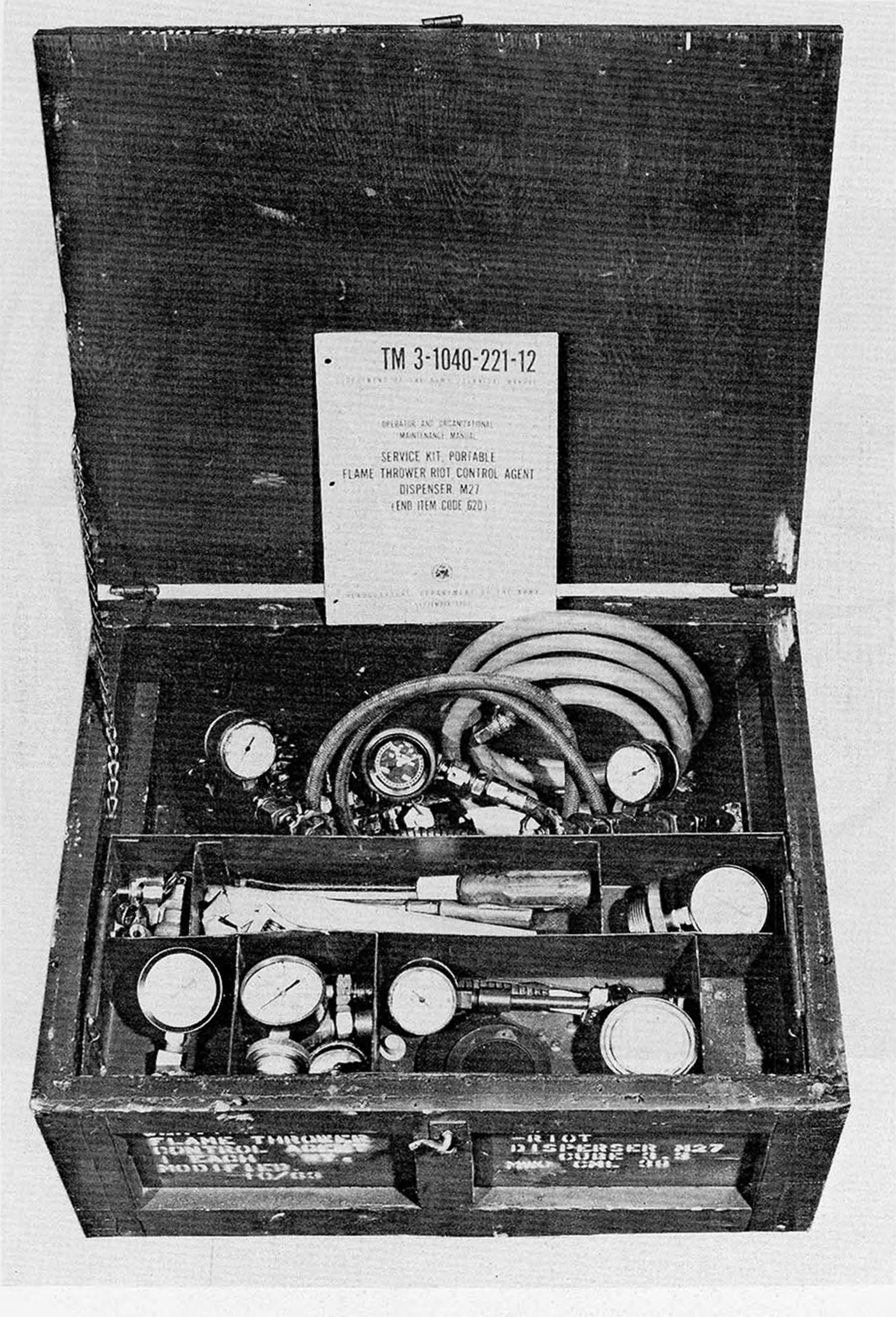

TM 3-1040-221-12
OPERATOR AND ORGANIZATIONAL
MAINTENANCE MANUAL
SERVICE KIT, PORTABLE
FLAME THROWER RIOT CONTROL AGENT
DISPENSER M27
(END ITEM CODE 620)
FLAME THROWER
MODIFIED
-RIOT
DISPERSER M27

Figure 5–7. M27 portable flamethrower-riot control agent disperser service kit.

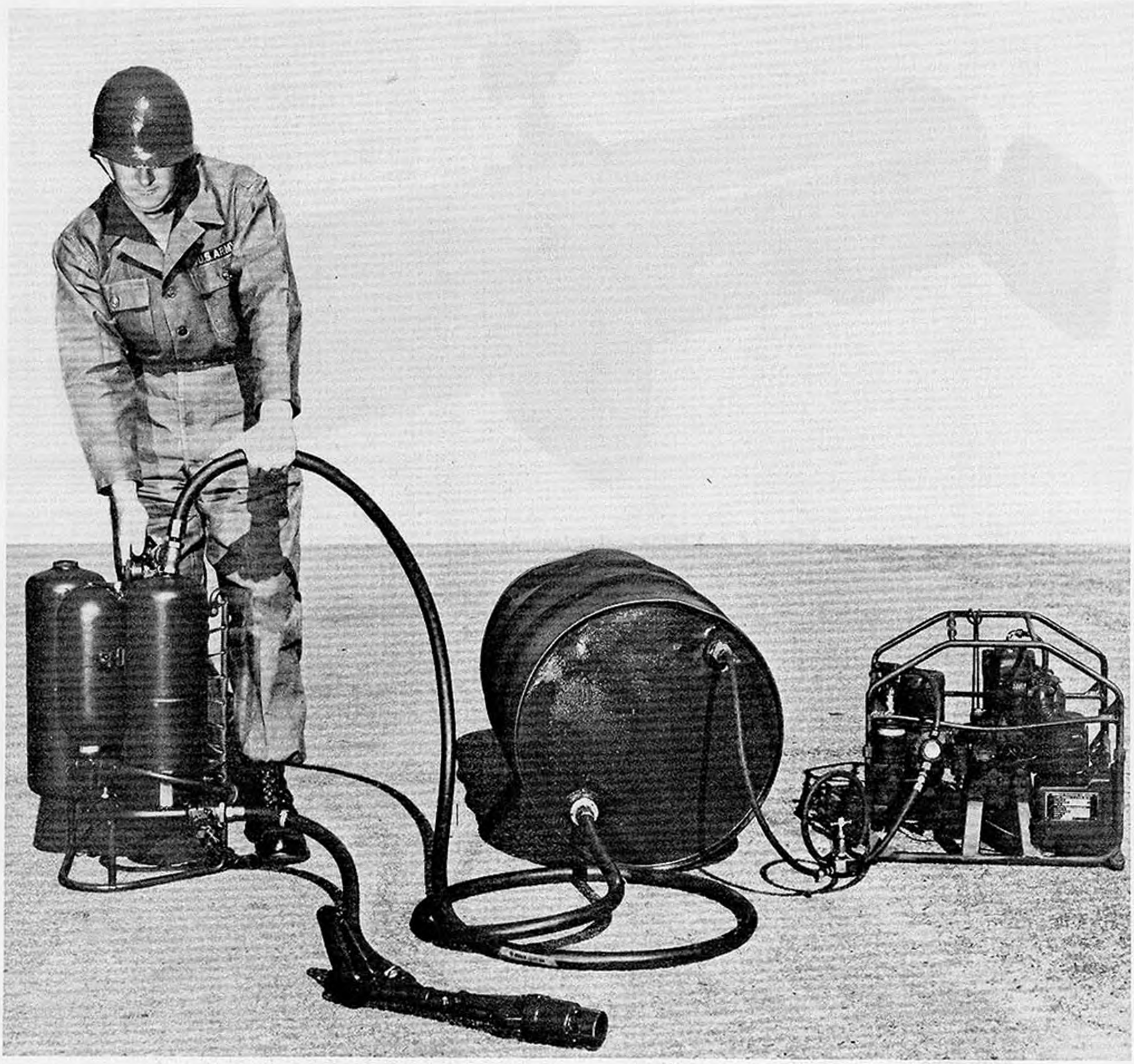


Figure 5–8. M27 service kit and AN–M4 compressor (3 1/2 CFM) used to fill a portable flamethrower from a 55-gallon drum of thickened fuel.

Section III. XM202 ROCKET LAUNCHER

5–7. Description and Characteristics

a. Description. The XM202 rocket launcher is a lightweight four-tube shoulder-fired weapon that fires XM74 rockets from the XM74 rocket clip (fig 5–9). The rocket clip is preloaded with four rounds. Each rocket warhead contains approximately 1.3 pounds of a thickened pyrophoric flame agent. Each round arms upon acceleration and detonates upon impact. A graze impact fuze initiates the detonator and detonating cord of the warhead. See TM 3–1055–218–12 for additional information on the XM202 rocket launcher.

b. Characteristics.

(1) *XM202 rocket launcher.*

(*a*) Overall length, closed (approx) — 27 inches

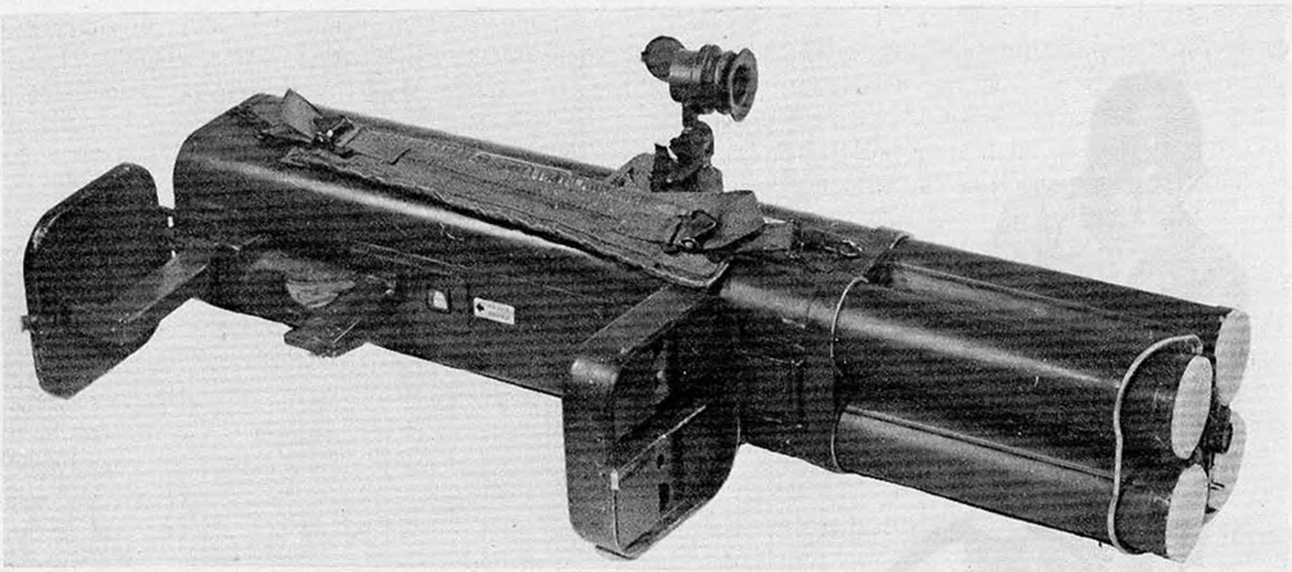


Figure 5–9. XM202 rocket launcher with rocket clip.

(*b*) Weight (approx) _11.5 pounds

(*c*) Operating temperature limits ____+32°F. to +140°F.

(2) *XM74 rocket clip.*

(*a*) Overall length, with rockets ___21.5 inches

(*b*) Weight of clip, with rockets ___15.1 pounds

(*c*) Storage temperature limits ____–40°F. to +140°F.

(3) *XM202 rocket launcher with rocket clip.*

(*a*) Overall length, firing position (approx)__34.75 inches

(*b*) Weight (approx) _26.6 pounds

(*c*) Range, effective (point targets) __200 meters

(*d*) Range, maximum (area targets)___750 meters

(*e*) Range, minimum safe (hard targets) __20 meters

(4) *XM74 rocket.*

(*a*) Overall length (approx) _21 inches (fins closed)

(*b*) Weight (approx) _3 pounds

(*c*) Muzzle velocity (approx) _375 feet per second

(*d*) Bursting radius (approx) _20 meters

5–8. Capabilities and Limitations

This rocket launcher is capable of firing one to four rounds semiautomatically at the rate of one round per second. The arming distance of the round is 5.5 to 13 meters of rocket travel. The launcher can be reloaded with a new rocket clip and prepared for firing in less than a minute. The effective range for point targets is approximately 200 meters; the maximum range is approximately 750 meters. The weapon can be fired from a prone, sitting, kneeling, or standing position. The launcher is safe to carry loaded with a full or partially fired clip. A clear field of fire to the target is required, since any obstruction between the weapon and the target may cause the fuze to function. The safety requirements pertaining to the backblast of the launcher may restrict use of the weapon under certain conditions. The rear danger zone is 40 meters; the minimum safe range is approximately 20 meters.

5-9. Targets

The following are some of the targets suitable for attack by the XM202 rocket launcher:

a. Pillboxes, bunkers, covered foxholes, and fortifications with small gun ports.

b. Personnel in open foxholes, trenches, or built-up areas.

c. Open ports, hatches, and engine air intakes of armored vehicles.

d. Unarmored vehicles (occupied or unoccupied).

e. Combustible supplies, ammunition, and materiel.

f. Sampans and similar watercraft.

g. Suspected enemy positions.

h. Personnel concealed in vegetation.

5-10. Target Effects

Personnel exposed to the heat and burning particles from the rocket warhead may become casualties as a result of burns, inhalation of hot gases and carbon monoxide, suffocation, and shock. The bursting munition may produce a profound psychological effect on personnel in the immediate vicinity of the burst. In many cases defending personnel may leave their positions, thus risking exposure to other weapons or capture. The burning particles from the rocket warhead are extremely difficult to extinguish and will ignite combustible materials on contact. The burning particles can penetrate gun ports, air intakes of vehicle engines, and other openings of vehicles and fortifications. The particles will produce serious burns on contact with the skin of personnel. The rocket normally is fired directly into the target or approximately 3 meters short of the target to allow the burning particles to splatter the target area. Upon impact of the rocket warhead, the burning fuel particles splatter, with most of the particles going to the sides and forward of the point of impact.

5-11. Tactical Employment

This weapon can be used to produce casualties and to destroy materiel. It may be employed like other direct fire weapons with the assault element or with a supporting element as a supporting weapon. It is normally employed by infantry elements in the assault of the objective for the same purpose as flamethrowers; however, targets can be engaged at a greater range and with greater accuracy with this weapon than with flamethrowers. Thus, the gunner is less vulnerable to enemy fire than are flamethrower operators. The launcher may also be used to reconnoiter by fire suspected enemy positions such as ambush sites. It is normally used as a special-purpose weapon operated by assigned personnel from within the platoon. This weapon team normally will require fire support and close-in protection to effectively engage the target.

5-12. Safety

Before the weapon is fired, the backblast danger zone must be clear of personnel, materiel, and obstruction and the field of fire to the target should be clear. Details on safety precautions pertaining to firing of the launcher and the rear area danger zone are contained in TM 3-1055-218-12.

Section IV. EMPLOYMENT OF PORTABLE FLAMETHROWERS

5-13. Considerations for Employment in the Offense

a. The portable flamethrower is a close-range assault weapon used to assist infantry units in the assault of the objective. It is normally used as special equipment by forward units when required. The decision to use portable flamethrowers is made by the unit commander.

b. In planning a flame attack, unit commanders should—

(1) Base their decision to use portable flamethrowers on a comparison of its capabilities with those of other available weapons.

(2) Plan to use the bulk of their flame strength with the attacking element most likely to make the best progress.

(3) Provide for sustained flame action by using flame in mass wherever possible.

(4) Provide for flexibility by using flame with reserve elements if not otherwise committed.

(5) Plan for the use of flame with maneuver elements and, in the assault, as a close fire support weapon.

c. The offensive use of portable flamethrowers is not limited to special operations. Special operations do not require a change of tactical doctrine, but do require some modification in the technique of applying the principles of offensive employment.

5–14. Principles of Employment

General principles of employment are given in chapter 2. Those principles requiring detailed consideration in the use of the portable flamethrower include the following:

a. Training. Frequent individual and integrated training in the use of the portable flamethrower in squad operations must be conducted when the combat situation permits.

b. Reconnaissance. The portable flamethrower is noticeable on the battlefield and may become an enemy target before it can be brought within range. Thorough reconnaissance lessens this disadvantage by enabling rapid movement to predetermined locations. The reconnaissance determines the—

(1) Exact location of enemy positions or emplacements to be attacked.

(2) Location of obstacles, wire, and mines.

(3) Most suitable covered routes of approach to the objective.

(4) Location of adjacent enemy positions from which fire may be expected or to which fire support and smoke may be directed to protect and screen the infantry and flamethrower assault.

(5) Blind spots or dead space leading to enemy positions to be attacked.

(6) Necessity for using demolitions or other special equipment to breach obstacles in the assault.

(7) Location of resupply point or route.

(8) Selection of flame firing positions.

c. Coordinated Fire Support. The range limitations of the portable flamethrower require that close, coordinated fire support be given to neutralize those positions or emplacements under attack and positions adjacent to or supporting those positions being attacked. This fire support is provided by the riflemen and other supporting fires controlled by rifle platoon and company commanders. During the final phase of the assault, close fire support should be maintained until the flamethrower is within effective range or until the assault group masks the supporting fires. (During the assault, close fire support is limited to flat trajectory fires.) Smoke screens should be planned to deny the enemy observation from those positions most likely to interfere with the attack. Artillery and mortar fires should be planned to interdict avenues of withdrawal on the flanks and rear of the objectives so that when the enemy is flushed out and demoralized by flame, he may be destroyed or captured.

d. Avoidance of Piecemeal Use. The vulnerability of the portable flamethrower operator and the limited amount of fuel often make it necessary to employ more than one portable flamethrower with the assault element. Whenever possible, the portable flamethrowers are put into action simultaneously.

e. Complete Integration With Assault Elements. The unit with which portable flamethrowers are used should be organized to provide maximum close fire support. A rifle squad can provide the necessary close fire support for its flamethrower, with the assistance of tanks and platoon and company supporting weapons. Except in special operations requiring the use of reinforced squads as assault teams, the tactical integrity of rifle squads should be maintained.

f. Rapid and Timely Resupply. Flamethrowers expend their fuel quickly. To insure continuous participation of flamethrowers in an action, fuel resupply points must be carefully planned for and closely supervised. Commanders at appropriate levels must select an adequately protected location (as far forward as possible) for a refueling and pressurizing point. The refueling and pressurizing installations must be mobile enough to follow the movements of the action. Rifle company commanders make timely requests for resupply, based on reports from platoon leaders; flamethrower replacements are exchanged in forward areas whenever practicable.

5–15. Preparation for Attack

General considerations relative to preparation for flame attack are given in chapter 2.

a. The rifle company commander indicates the platoon with which portable flamethrowers will be used. If mechanized flamethrowers are attached, the company commander decides whether portable flamethrowers will also be used. The battalion should provide sufficient flame weapons to the reserves so that sustained flame action will be possible.

b. The platoon leader assigns portable flamethrowers to one or more squads and indicates the role that they will play in seizing the platoon objective. He prescribes measures for close-in protection and resupply. He orients the squad leader on the plan of employment of the flamethrowers. The squad leader conducts his own detailed orientation and assigns a specific objective to the flamethrower operator.

c. While troops are in the assembly area, flamethrower operators perform equipment checks on their weapons under the supervision of the platoon leader.

5-16. Conduct of Attack

The portable flamethrower is used aggressively by the platoon leader. When both portable and mechanized flamethrowers are used on the same objective, their action is coordinated.

a. During the attack, the squad leader uses the portable flamethrower against enemy resistance holding up his progress. Conduct of fire is his responsibility. Under covering fire of the squad or other supporting weapons, the flamethrower gunner moves forward to a selected firing position within range of the flame target. The squad leader constantly observes the progress of the flamethrower gunner to make certain that he is not endangered by friendly fires and that adequate fire support is applied to allow the flame weapons to close with the target.

b. During the assault, the flamethrower gunner engages the target to cover friendly infantry approach onto the objective during the time that some supporting fires may be restricted because of safety limitations. Flamethrower gunners join the squads on the objective.

c. Portable flamethrower gunners remain with their squad during the reorganization and occupation of the objective area. During reorganization and consolidation, they are positioned to cover likely avenues of approach. Empty flamethrowers are immediately replaced or reserviced.

5-17. Specific Tactical Situations

The employment of portable flamethrowers with mechanized infantry is the same as with other infantry units. Using the principles outlined in paragraph 5-14, modified to meet existing conditions, portable flamethrowers can be used advantageously in the following tactical operations:

a. Approach March. The portable flamethrower may be used by the rifle unit serving as the advance guard to overcome small enemy strongpoints, positions, or parties holding up the advance. Portable flamethrowers may be transported on carriers until contact is made and their use is required in advance guard action.

b. Attack in Hedgerow Country. The portable flamethrower is effective against strongpoints of resistance and automatic weapon positions in partly inclosed terrain such as hedgerow country and sparsely wooded areas. Targets frequently appear at the junction of hedgerows. The method used to attack these positions is called attacking the "T." A thorough reconnaissance is needed to find covered avenues of approach for the flamethrower operator.

c. Attack Against Isolated Buildings. The portable flamethrower is an excellent weapon to support an attack against isolated buildings that have been organized as strongpoints. Ordinary farm buildings provide little protection against flame. Even stone and brick buildings have vulnerable spots such as doors, windows, and roofs. A good incendiary effect may be obtained by firing "wet shots" first (allowing thickened fuel to adhere to the building) and then firing ignited shots. Flame usually shortens the time required to reduce this type of defense because it creates in the defenders' minds and overwhelming fear that they are trapped and will be burned to death unless they withdraw or surrender.

d. Forest and Jungle Fighting. Portable flamethrowers are useful in this type of terrain against strongpoints and well-organized positions. Here both cover and concealment afford excellent opportunities for the close-in use of flame. By flaming a general area, flamethrowers can burn away camouflage and expose enemy positions. Even if the enemy is not actually hit by the flame, the burning undergrowth and resulting smoke may make his position untenable.

e. Mopping Up. In a fast-moving situation, portable flamethrowers can be used to reduce pockets of resistance that interfere with the advance. In these situations, the enemy is quite often deprived of his heavier supporting fires and is less inclined to put up stubborn resistance when faced with flame. Reserve units, particularly, should use the portable flamethrower in this role when the situation requires.

f. Village and Street Fighting. Flame is a great asset in this type of fighting. It is often the quickest, surest, and most economical method of dislodging an enemy from a building. However, the attacker must use flame carefully because the resulting fire may become an obstacle to his advance. The normal assault techniques of town fighting are easily adapted to allow flame support. See FM 31–50 for a discussion of combat in built-up areas.

(1) *Level of building entry.* As discussed in FM 31–50, the preferred order of building level entry is as follows: entry on uppermost level, entry on middle level, and entry on ground level. When attack of a building is supported by portable flamethrowers, there are additional considerations. Control over the length of the burst is limited by walls and floors. The possibility also exists that firing the building on a lower level may trap assaulting troops entering on upper levels.

(2) *Covering fires.* Portable flamethrowers provide excellent covering fire within their range limitations.

(3) *Use with the rifle squad.* The rifle squad is divided into two groups: the covering party and the searching party. The searching party may consist of a fire team leader and four riflemen; the squad leader and the remainder of the squad make up the covering party. The flamethrower may be used with either party. It can be used as a covering weapon to drive the enemy from firing ports or slits. With the searching party, it may be used to flush rooms before the remainder of the searching party enters them. It is best to use thickened fuels where accuracy in firing into small slits or apertures is necessary. Unthickened fuel is more appropriate when a large, rolling mass of flame is desired. The number of flamethrowers used is limited only by the ability of the squad and platoon to provide coordinated fire support and close-in protection. Certain limitations such as firing time and the fuel resupply problem must be recognized.

(4) *Reorganization.* The object of reorganization is to prevent the enemy from regaining a foothold within the buildings. Flamethrowers are excellent weapons to deny avenues of approach to the enemy. "Wet shots" may be fired to cover key avenues of approach expected to be used by the enemy advance. The fuel covering these avenues can then be ignited at such time as to catch the enemy in the most vulnerable position. In all cases, riflemen should provide close-in protection for the flamethrower gunners.

g. Attack of a Fortified Position. In the attack of fortified bunkers, portable flamethrowers are employed in the final assault in conjunction with other close fire weapons. Portable flamethrower gunners move within range of targets under covering fire of small arms and close support weapons. Once within range, targets are taken under fire, using flame bursts and wet shots as appropriate for specific target vulnerability. Portable flamethrowers may also be used to provide covering fire for engineers and infantry emplacing demolition charges and bangalore torpedoes. Initial bursts are fired from an oblique blind position with respect to the bunker embrasure, followed by direct shots into the bunker. FM 31–50 covers the doctrine on the attack of fortified positions.

h. Fighting in Dikes and Canals. In this type of fighting, with the enemy often entrenched on the reverse slope of a dike, portable flamethrowers should be used whenever they can reach the target. The searching characteristics of flame will aid in flushing the enemy out of his position. An immediate followup by maneuver forces with grenades and small arms is essential.

i. Attack of a River Line. In offensive actions of this type, flamethrowers should be used to reduce strongpoints of resistance and automatic weapon positions close to the river line. Because boats can move safely through the fuel burning on the water, portable flamethrowers may be fired as the boats close within effective range of the enemy-held banks.

j. Night Attacks.

(1) The night attack offers a good opportunity for the successful employment of the portable flamethrower. In nonilluminated night attacks, the enemy will find it difficult to recognize the weapon and concentrate fire on it before it comes within flame range. The portable flamethrower may be used in all types of night attacks either illuminated and supported or nonilluminated and unsupported or other combinations, without change in the current tactical doctrine for night attacks. Thickened fuel should be used to obtain maximum range.

(2) During the advance to the probable line of deployment, flamethrower gunners and the riflemen with them must move as silently as possible. When the probable line of deployment is reached, gunners should be positioned in the center of their deployed squad to facilitate control by squad leaders. If the enemy compels early deployment, the assault is begun as soon as full deployment is complete. Under these circumstances, flamethrower operators withhold their fire until within range. When the assault troops deploy undiscovered, they move off in the assault, maintaining silence until fired on or until receiving the signal to fire. At this time the entire assaulting force should open fire, but flamethrower operators should withold their fire until they are within range. In either case, the

flame should be applied to give as much lateral coverage as possible.

(3) Flamethrower gunners should be sent as soon as possible to the predetermined resupply point for resupply. They should rejoin their units as quickly as possible. During reorganization and consolidation, platoon leaders should position flamethrowers to cover likely avenues of approach to the objective.

k. Raids. The portable flamethrower is employed during raids in the same manner that it is employed for day and night attacks. Since raids are characterized by immediate withdrawal of the raiding force after accomplishing its mission, consideration must be given to the practicability of carrying the portable flamethrower for the distances the raiding force must travel. The use of the portable flamethrower must not jeopardize the ability of the raiding force to withdraw immediately.

l. Operations in Mountainous Terrain. The basic principles of flame employment can be adapted to operations in mountainous terrain. The judicious use of screening smokes permits flamethrower gunners to advance within flame range of an objective. The weight of the portable flamethrower limits its mobility in mountainous terrain, and it is difficult to establish a convenient resupply point.

m. Desert Operations. In desert operations the care and cleaning of portable flame weapons is of particular importance. The difficulties of preparing and storing thickened fuels in a hot climate must be overcome. A general lack of good cover and concealment emphasizes the need for a thorough reconnaissance in order to exploit the few advantages the terrain may offer. Completely coordinated fire support and the use of screening smoke will be especially important.

n. Operations in Snow and Cold Climate. Usefulness of the portable flamethrower lessens with a decrease in temperature. In oversnow operations, tactical mobility and maneuverability may be impeded because of weight limitations, particularly where troops do not have the support of tracked vehicle carriers. Portable flamethrowers should be transported in tracked vehicle carriers as far forward as practicable. The squad sled may also be used to transport the portable flamethrower when required. The effacts of weather on flame fuels and weapons are discussed in paragraph 1–5*d*.

o. Amphibious Operations. When landings are opposed by strong beach defenses, portable flamethrowers can be used profitably to reduce enemy emplacements in much the same manner as in the attack of a fortified position (*g* above). This type of defense may require the organization of special assault teams and reinforced rifle squads, depending on the number and type of obstacles encountered and on the characteristics of the emplacements. In situations requiring the use of portable flamethrowers against strong beach defenses, planning must include arrangements to insure rapid resupply on a weapon-for-weapon basis in the early stages of the landing, and the early establishment of refueling and pressurizing points ashore as soon as progress inland permits.

p. Airborne Operations. Portable flamethrowers should be made available to the assault forces in the initial phase of an airborne attack if sufficient aircraft are available to permit their use with the assault echelon without sacrificing the firepower of other essential weapons. If a shortage of aircraft prevents the employment of flame in the assault phase, flame should be employed in the followup phase to reduce enemy defenses.

q. Riverine Operations. Portable flamethrowers can be used in riverine operations to force occupants from small cave and tunnel complexes, to attack fortified positions, and to counter ambushes.

5–18. Employment in the Defense

Portable flamethrowers can be used effectively in the defense. The principles of employment discussed in paragraph 5–14 should be applied and modified to fit the situation. Consider the following:

a. Locations. The short range and limited firing time of the portable flamethrower require that it be carefully positioned for maximum effect. It must be supported by other weapons and integrated into the fire plan. Covered routes are prepared to alternate and supplementary positions. All flamethrowers organic or attached to forward units usually are positioned along the FEBA; those with reserve units provide depth and flame for the counterattack. The location of the portable flamethrower is coordinated with that of other flame weapons.

b. Uses. In defensive operations the portable flamethrower is used primarily to stop enemy assaults that have almost reached the FEBA. The portable flamethrower may be used to neutralize enemy tanks that are vulnerable. Reserve units use flamethrowers to limit penetrations and support the counterattack. Normally, portable flamethrowers are not used by security forces forward of the FEBA. The flamethrower gunners may also be charged with detonating emplaced flame devices in their sector of observation. Portable flamethrowers may be used in internal defense operations, applying the same principles as in other types of operations.

c. Resupply. Resupply may be accomplished by exchanging an empty weapon for a loaded one.

CHAPTER 6

FLAME FIELD EXPEDIENTS

6–1. General

Flame field expedients may be used for casualty effects, illumination effects, or signaling effects. These expedients include exploding flame devices, flame fougasses, and flame illuminators. Exploding fougasses may also be used as improvised flame mines. The flame field expedients discussed in this chapter have been used and found to be effective in combat. Variations and adaptations of these field expedients, designed to meet specific situations, are limited only by the imagination and initiative of combat personnel using them. For information on delivery of flame field expedient devices by Army aircraft, see paragraph 7–13.

a. Controlled Weapons. Flame field expedients initiated by the commander of the using unit are considered to be a part of the final protective fires of that unit. They are not reported as mines, but the using unit must make sure that they are detonated or removed before the unit leaves the area, unless by mutual agreement they are turned over to another unit.

b. Uncontrolled or Contact Weapons. When exploding flame devices and flame fougasses are used for contact detonation by the enemy, they are considered improvised flame mines. Their locations are marked, reported, and recorded according to the procedures set forth in FM 20–32.

6–2. Tactical Uses

Flame field expedients are used chiefly in defensive operations; however, they may also be used in offensive operations. They may be used in all types of minefields: protective, defensive, barrier, nuisance, or phony. Tactically, flame field expedients are used to—

a. Warn of enemy approach. They are used in defiladed areas or during periods of limited visibility.

b. Produce casualties by splattering personnel with thickened fuel or by striking personnel with fragments of the container. The high radiant heat of the fireball will also cause casualties.

c. Deter the enemy by their psychological impact.

d. Produce limited battlefield illumination to silhouette the opposing force.

e. Restrict the use of most likely avenues of approach that cannot be covered easily by direct fire weapons. Exploding flame devices and fougasses can be used for this purpose.

f. Force the enemy into areas where he may be more profitably engaged.

g. Provide support of offensive operations. Flame field expedients may be used in close proximity to friendly positions, alone or with barbed wire or other obstacles. They may be used either by themselves or with high explosive (HE) and chemical landmines in composite minefields. When exploding flame devices are emplaced in composite minefields, the effects of flame on other obstacle components such as tripwires must be considered. If flame field expedients are to be placed in a field containing chemical mines, they must be emplaced so that the flame will not vaporize or burn the chemical agent.

6–3. Types

a. Exploding Flame Devices. An exploding flame device consists of a container, an incendiary fuel (usually thickened gasoline), and a firing system to scatter and ignite the fuel. The size of the area it will cover depends on the size of the container and the firing system. It may be detonated by the M4 incendiary burster (fig 6–1), or it may be detonated by some other available explosive used with the white phosphorus (WP) hand grenade, which serves as an igniter. There is no standard exploding device. However, experience indicates that claymore mine explosive components, which are waterproof, are less subject to explosive component breakdown than are most other explosive components used in flame field expedients.

(1) *Controlled type.*

(*a*) A 5- to 20-gallon metal container may be used (fig 6–1). It is emplaced on the sur-

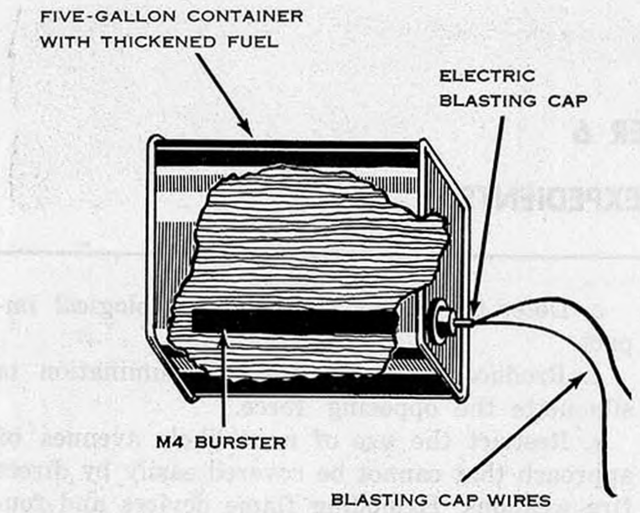


Figure 6–1. Exploding 5-gallon flame device with M4 burster.

face or in a V-trench. The 5-gallon device, because of its weight and limited area of effect, may be rapidly emplaced by the individual or small unit as a close protective measure. A trench can be used to give some direction to the flame. A 5-gallon container will cover an area approximately 20 to 30 meters in diameter.

(*b*) Large metal containers (usually 55-gallon drums) filled with thickened fuel may also be used (fig 6–2). These weapons inflict casualties by the action of the burning fuel and flying pieces of the metal container. They have a great psychological effect. A 55-gallon container (fig 6–3 and 6–4) will cover an area approximately 85 meters in diameter. For maximum fragmentation effect they may be wound tightly with barbed wire and engineer pickets (fig 6–5). Two 55-gallon containers welded together can provide an effective flame device.

(*c*) The M4 incendiary burster may be used with any container into which it can be inserted. One burster is sufficient for a 5-gallon container (fig 6–1). Bursters can be joined together to rupture larger containers. The 55-gallon drum requires a minimum of two bursters. The incendiary burster or bursting charge should be placed so as to throw the flame fuel up and out. These flame expedients produce some illumination.

(2) *Contact type.* All exploding flame devices may be emplaced for contact detonation as improvised flame mines. Since a lone enemy soldier usually detonates a contact device, a 5-gallon oil can containing thickened fuel is sufficient. The ignition system and the can itself may be wound tightly with barbed wire for fragmentation effects (fig 6–6). This weapon is most effective when emplaced in the open where obstruction will not decrease the fragmentation effect against personnel. Best results are obtained when it is emplaced in well-camouflaged positions approximately 2 meters above the ground in branches of trees, bushes, or hedges.

(3) *Hasty emplacement.* For hasty or overnight-type defensive operations (and in the absence of metal containers), holes may be dug in the ground, filled with previously thickened fuel, and fixed with an exploding device. If available, plastic containers or any suitable material may be used to line the inside and cover hasty flame field expedient emplacements. Depending on the size of the hole and on the amount of thickened fuel and explosive charge used, area covered will vary.

b. Flame Fougasses. The flame fougasse is a variation of the exploding flame field expedient in which the flame is projected by explosive means over a preselected area. The flame fougasse may also be used as a controlled weapon or an improvised flame mine. The container for this weapon may take one of several forms; for example—

(1) A metal cylinder or a propellant charge container (fig 6–7), open at one end, dug in, and firmly braced at an angle that will give maximum effect over the area selected for attack. Where terrain conditions (such as water or rocks) prohibit burying the container, it can be heavily sandbagged. It will project flame approximately 45 meters.

(2) A 5- to 55-gallon metal container emplaced in a V-trench (fig 6–8). Explosives placed behind the container give direction to the burning fuel.

(3) A hasty flame fougasse (without a metal container) for overnight-type defensive operations can be constructed in a manner similar to that described in (1) and (2) above. The range will be slightly reduced, however.

c. Flame Illuminators. A number of flame devices may be used to produce limited battlefield illumination. All flame field expedients give an initial flash from the detonation and ignition of the thickened fuel. Thickened fuel thrown on the ground as a result of the detonation continues to burn for 5 to 10 minutes and provides some illumination. True flame illuminators are constructed to provide extended burning time with maximum illumination, although they may

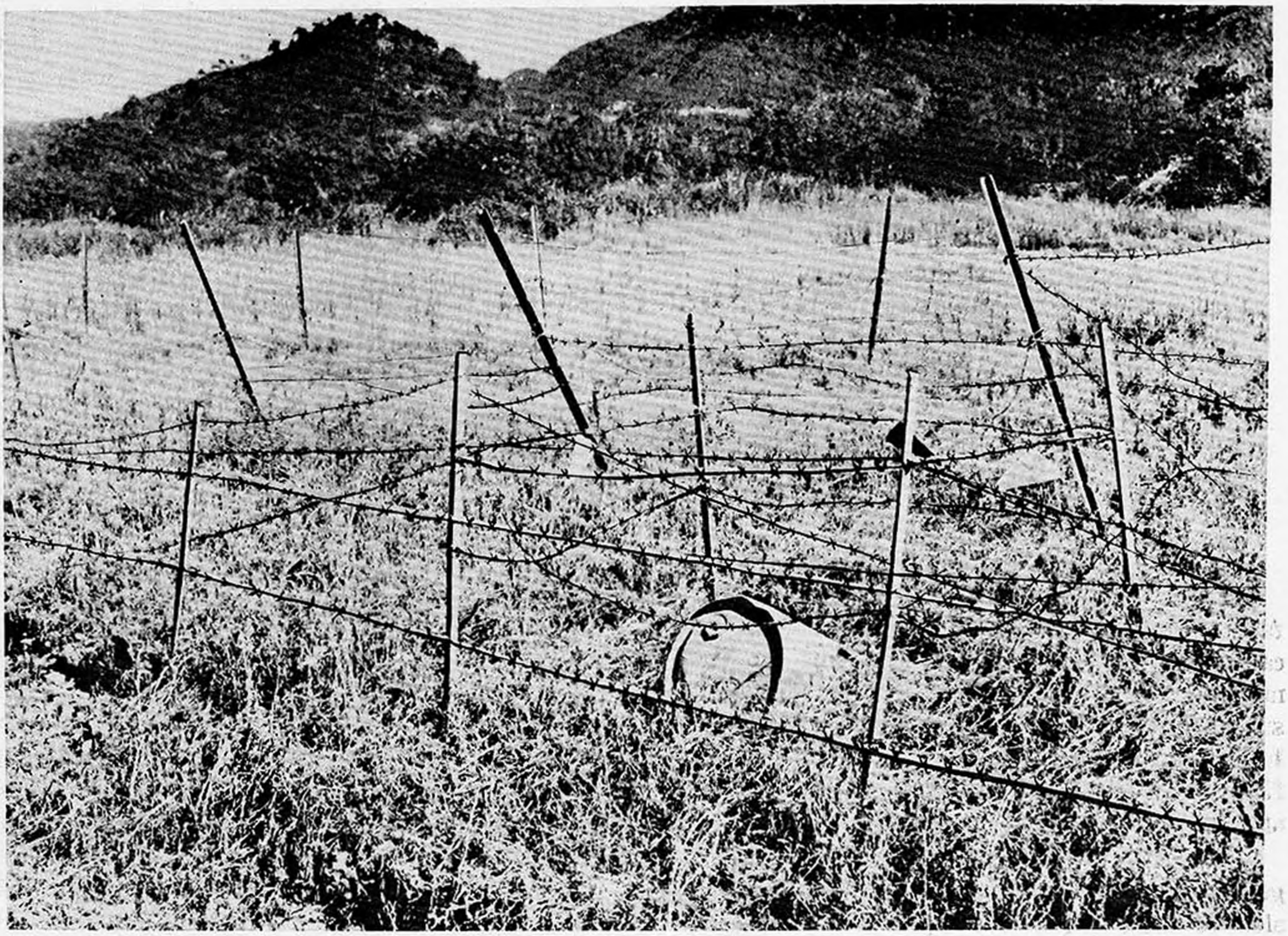


Figure 6–2. Emplaced 55-gallon exploding flame device.

also produce casualties. Flame illuminators may be used for warning as well as illumination by contact detonation. Some improvised flame illuminating devices are discussed below. Others are described in FM 20–60.

(1) A 5- to 55-gallon drum filled with thickened fuel, tightly sealed, and set in a hole so that the top is slightly below ground (fig. 6–9) can be used. Coils of detonating cord are wound around the inside edge of the top of the drum. The coil is tightly tamped with earth. When detonated, the cord cuts off the top of the drum and a white phosphorus hand grenade ignites the fuel. It burns for several hours. Time of burning can be controlled to some extent by the size of the container, by the thickness of the fuel mixture, and by the addition of straw or dirt. It cannot be easily extinguished without use of specialized firefighting equipment.

(2) A hasty flame illuminator, to be fired within 12 hours after emplacement, can be constructed by digging shallow holes or trenches in selected avenues of approach, filled with previously thickened fuel, and fixed with an igniter system.

(3) Water illuminators can be set up by pouring gasoline, oil, or thickened fuel on the surface of calm water and igniting.

(4) Illuminators for defense perimeters can be constructed by using No. 10 food cans, empty .50 caliber ammunition cans, or similar containers (fig 6–10). The container is half filled with sand and half filled with diesel fuel and covered with paper. A trip flare is used to ignite the fuel. The containers are strategically emplaced (with tripwires or wires for remote control) at 50-meter intervals within the forward edge of the defensive perimeter. Upon activation these illuminators will provide some illumination for about 45 minutes.

(5) An illuminated signal arrow (fig 6–11) consisting of a series of used individual ration cans filled with an equal mixture of diesel fuel

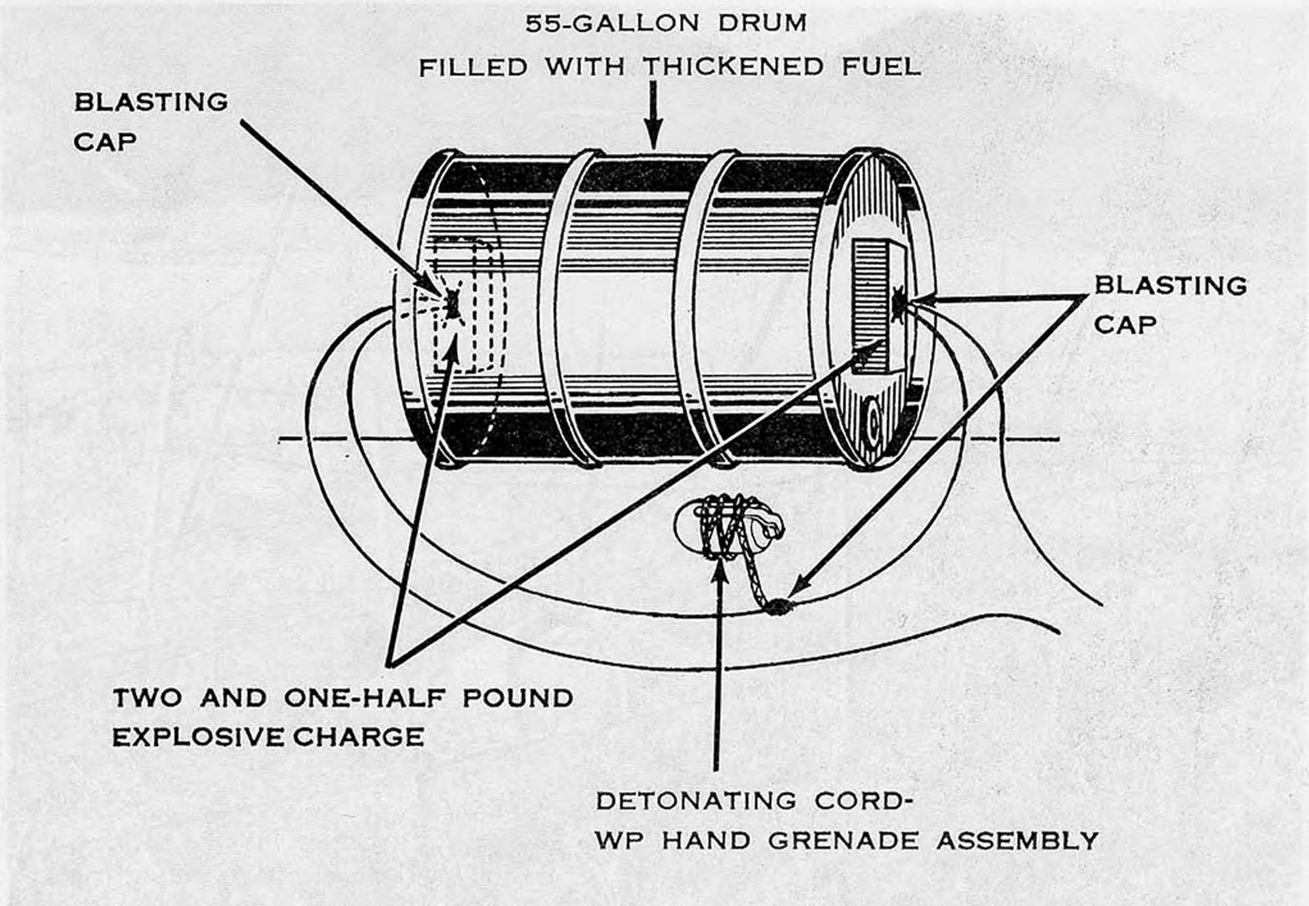

55-GALLON DRUM
FILLED WITH THICKENED FUEL
BLASTING
CAP
BLASTING
CAP
TWO AND ONE-HALF POUND
EXPLOSIVE CHARGE
DETONATING CORD-
WP HAND GRENADE ASSEMBLY

Figure 6–3. Exploding 55-gallon flame device (explosive charge).

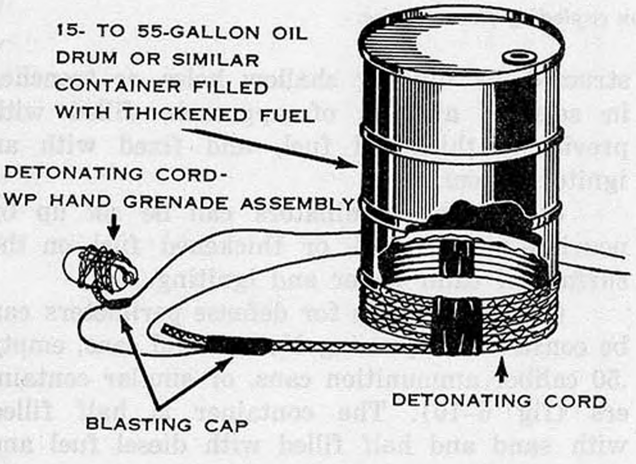

15- TO 55-GALLON OIL
DRUM OR SIMILAR
CONTAINER FILLED
WITH THICKENED FUEL
DETONATING CORD-
WP HAND GRENADE ASSEMBLY
DETONATING CORD
BLASTING CAP

Figure 6–4. Exploding 55-gallon flame device (detonating cord).

and JP–4 (or equivalent) fuel may be used. The number of cans on the stem of the arrow indicates the number of meters/increments to the enemy location (for example, each can may represent 100 meters). When a unit is under attack at night, the cans are arranged (according to air-ground agreement) to form an arrow pointing toward the direction from which the position is being attacked. The fuel in the cans is then ignited. When the situation permits, the cans may be arranged on an arrow-shaped board mounted on a spindle emplaced in the ground. When the unit is under attack, the arrow may be rapidly pointed in the direction of attack and fuel in the cans ignited. This arrow can be clearly seen by pilots of supporting aircraft.

(6) Coating the water of canals, ditches, and moats with petroleum products and then command-igniting them can provide an effective illuminator and a formidable obstacle.

6–4. Firing Devices

See FM 5–25 for details on electric and non-electric firing systems.

a. When flame field expedients are to be detonated electrically, they may be detonated with the 10-, 50-, or 100-cap blasting machine. Expedients can be wired for electrical firing of individual devices or of selective devices in a group, or for simultaneous explosion of an entire group of devices.

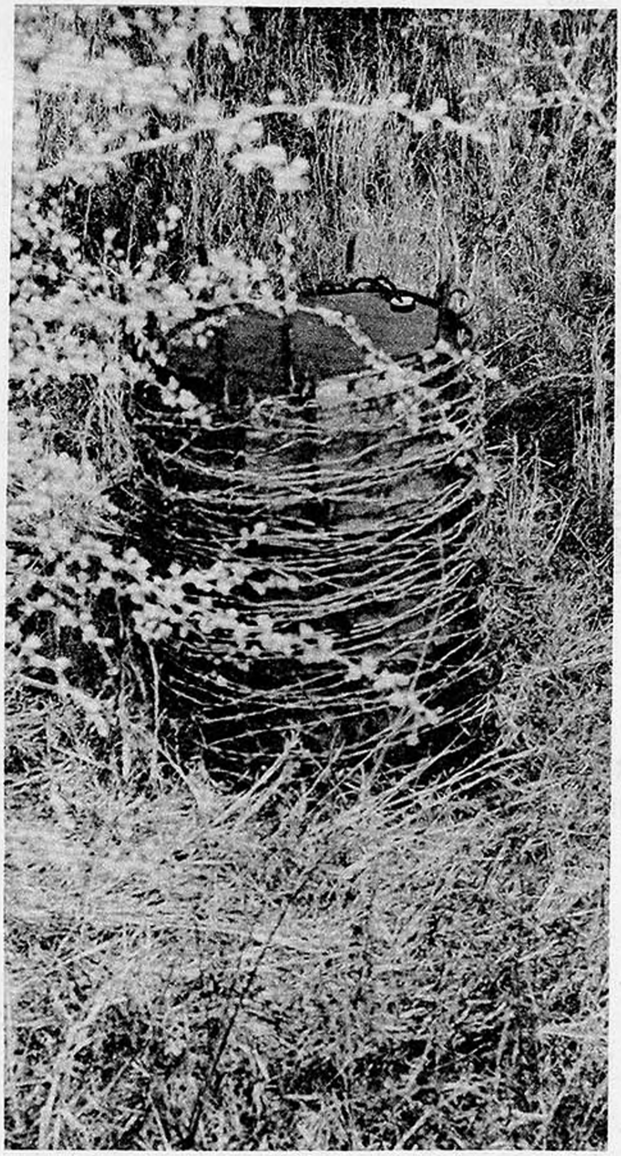
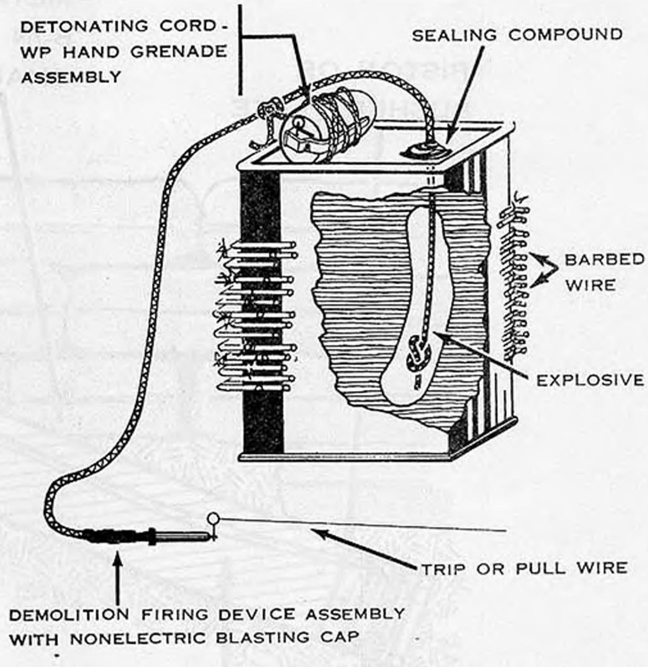


Figure 6-5. Fragmentation exploding 55-gallon flame device (three M4 bursters) emplaced.

b. A switchboard permitting selective firing of flame field expedients can be improvised from a board and nails. The wires for each circuit are tagged for identification. Firing is accomplished by touching the bare leads to a battery or other electrical power source. The voltage from the battery or electrical power source required to fire flame field expedients will depend on the electrical wiring systems, length of the electrical wires, and number of blasting caps to be fired. WD-1/TT communication wire, which is commonly used, has a high resistance, thereby requiring an increase in the power source.

Note. Alternating current from a TA-312 field telephone will not fire a blasting cap.



DETONATING CORD-WP HAND GRENADE ASSEMBLY
SEALING COMPOUND
BARBED WIRE
EXPLOSIVE
TRIP OR PULL WIRE
DEMOLITION FIRING DEVICE ASSEMBLY WITH NONELECTRIC BLASTING CAP

Figure 6-6. Fragmentation exploding flame device (explosive charge or M4 burster).

c. Standard tripwire firing devices for immediate or delayed activation may be used.

d. Electric and nonelectric blasting caps may be used with various bursting and ignition devices such as WP grenades, TNT, composition C4, detonating cord, igniter-time fuze, and M4 bursters.

e. The M4 incendiary burster may be fired either electrically or mechanically by fuze, blasting cap, detonating cord, or any standard firing device.

(1) The burster may be fired by an M206-A2 detonating fuze, the firing system discussed in FM 5-25, or the firing devices discussed in FM 5-31. The fuze firing system or the standard firing device is screwed into the threaded hole in the plug so that it projects in the plastic burster cup in the top of the inner plastic tetryl tube.

(2) Blasting caps (no. 8) or detonating cord may be used in a similar manner. Care must be taken in both cases to secure the firing device to the bottom of the plastic burster cup with tape.

f. Detonating cord for the WP hand grenade assembly is the primary means of providing an ignition system to ignite the thickened fuel in flame field expedients. The assembly is prepared by securing the fuze handle tightly to the grenade body with tape, spreading the fuze cotter

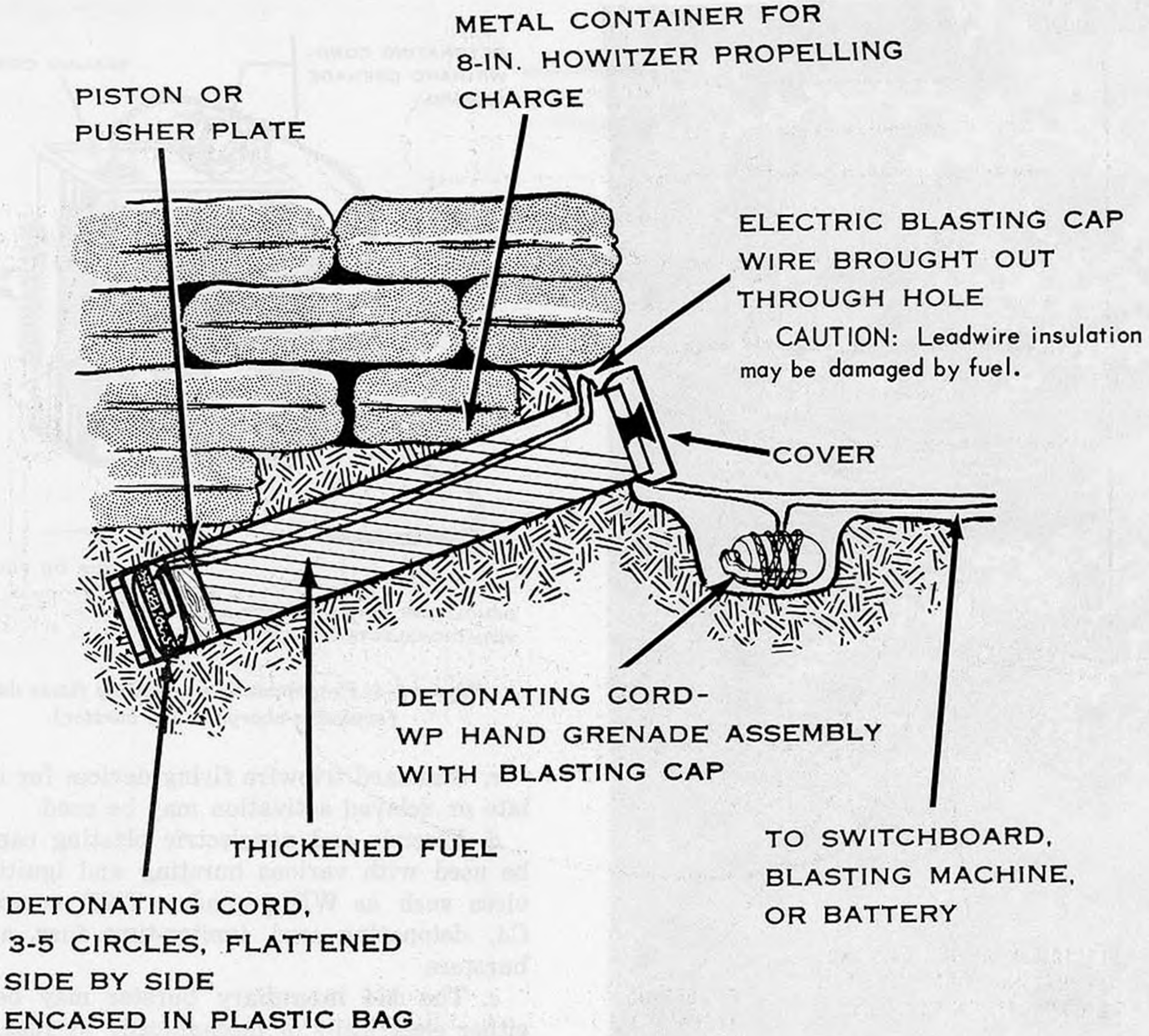

METAL CONTAINER FOR 8-IN. HOWITZER PROPELLING CHARGE
PISTON OR PUSHER PLATE
ELECTRIC BLASTING CAP WIRE BROUGHT OUT THROUGH HOLE
CAUTION: Leadwire insulation may be damaged by fuel.
COVER
DETONATING CORD-WP HAND GRENADE ASSEMBLY WITH BLASTING CAP
THICKENED FUEL
TO SWITCHBOARD, BLASTING MACHINE, OR BATTERY
DETONATING CORD, 3-5 CIRCLES, FLATTENED SIDE BY SIDE ENCASED IN PLASTIC BAG

Figure 6–7. Flame fougasse (howitzer propelling charge container).

pin tips, and wrapping five to ten turns of detonating cord around the grenade body and securing the cord with a clove hitch. An alternate method for detonating the WP grenade with detonating cord is to place five to ten folds of detonating cord side by side on the grenade's side, securing the cord with tape. The grenade assembly is prepared for firing and installation by attaching a blasting cap to one end of the detonating cord.

Note. It is not necessary to remove the cotter pin to permit functioning because of sympathetic detonation of the grenade burster will result from the detonating cord.

6–5. Capabilities and Limitations

Flame field expedients are capable of providing an effective deterrent against enemy personnel and vulnerable armor. Careful planning is needed to insure the use of sufficient flame weapons of effective size in the right places. The plans must allow enough time to procure the materials, assemble them, and emplace the completed weapons. In offensive operations the 5-gallon exploding flame device, because of its size and weight, lends itself to rapid installation as a hasty defensive weapon. The 55-gallon device requires greater logistical effort. Alternate means of firing the weapons should be provided to make certain they will function when needed. Electrical firing wires may be laid on the surface of the ground, but if time permits they should be buried at least 18 inches to prevent cutting by bombing or artillery and mortar fire. When thickened fuel is used in flame field expedients against personnel in the open, it is more effective than unthickened fuel because of its greater range and longer burning time.

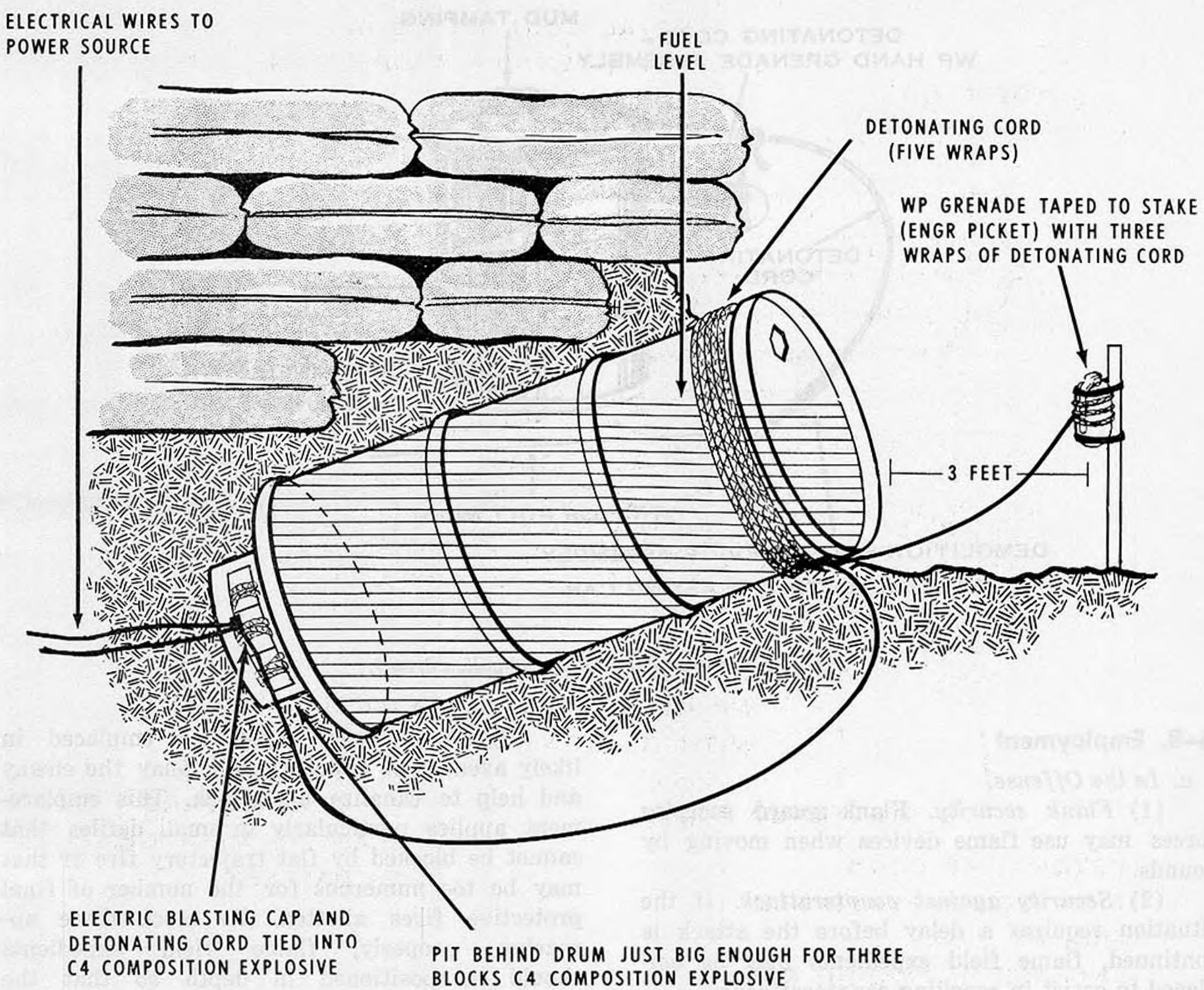

ELECTRICAL WIRES TO POWER SOURCE
FUEL LEVEL
DETONATING CORD (FIVE WRAPS)
WP GRENADE TAPED TO STAKE (ENGR PICKET) WITH THREE WRAPS OF DETONATING CORD
3 FEET
ELECTRIC BLASTING CAP AND DETONATING CORD TIED INTO C4 COMPOSITION EXPLOSIVE
PIT BEHIND DRUM JUST BIG ENOUGH FOR THREE BLOCKS C4 COMPOSITION EXPLOSIVE

Figure 6–8. Flame fougasse (55-gallon drum).

6–6. Camouflage

Maximum casualty effects of exploding flame devices depend on their proximity to the enemy at the time of detonation. Personnel responsible for emplacement of flame devices should be well qualified in the use of artificial and natural camouflage. They should be capable of preparing flame field expedient emplacements that will not be obvious to an attacker until he is well within effective range.

6–7. Authority To Lay and Activate Flame Field Expedients

The unit commander is responsible for use of flame field expedients as controlled weapons or illuminators, and it is under his authority and discretion that controlled-type flame devices may be detonated. He is responsible for emplacement and removal of all flame field expedients. If the unit emplacing the flame expedients is required to move, that unit commander is responsible for the removal of the devices or for the proper transfer of them to the relieving unit. Flame field expedients when used as improvised flame mines may also be integrated into minefields, in which case they must be controlled in the manner prescribed for actual mines in FM 20–32. Two basic patterns for emplacing exploding flame devices are illustrated in figure 6–12.

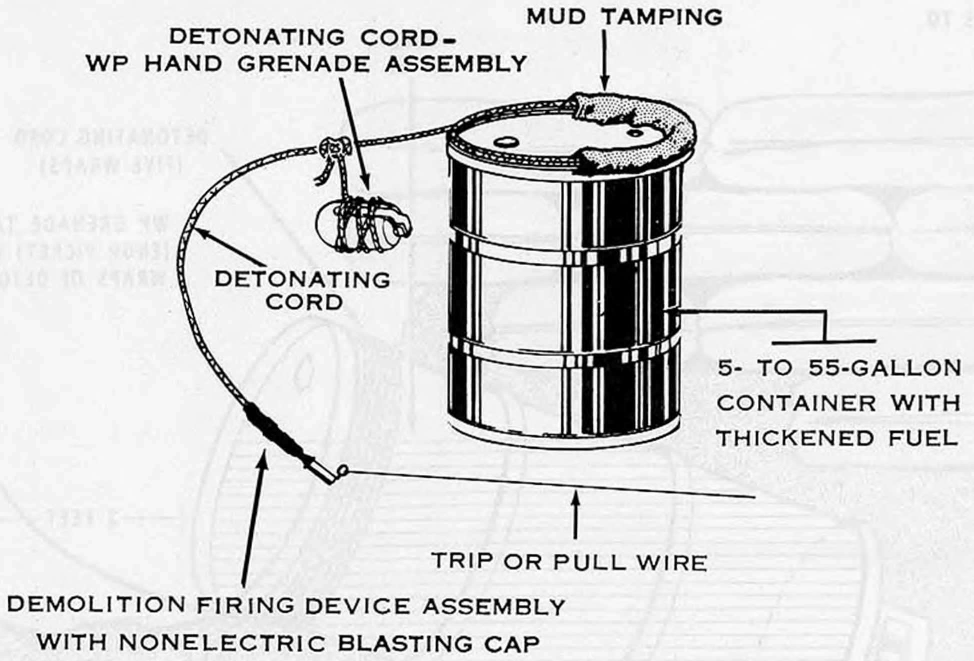


Figure 6–9. Flame illuminator (55-gallon drum).

6–8. Employment

a. In the Offense.

(1) *Flank security.* Flank guard security forces may use flame devices when moving by bounds.

(2) *Security against counterattack.* If the situation requires a delay before the attack is continued, flame field expedients may be emplaced to assist in repelling counterattacks.

(3) *Tunnel clearance.* Some types of flame field expedients may be used to clear tunnels.

(4) *Clearance of vegetation.* Flame field expedients may be used to remove vegetation, such as hedgerows, in the path of advancing troops.

(5) *Ambush fire plan.* Flame field expedients may be used to supplement the ambush fire plan.

b. In the Defense.

(1) As security forces withdraw, they may leave improvised flame mines in approach routes forward of the battle position to delay the enemy's advance. Security echelons may use flame devices (with tripwires or remote control) forward of the battle position. If they are not used to repel attacks on the position, they may be left to be fired by tripwires. Flame field expedients emplaced forward of the final protective line can cause casualties, warn of enemy approach, and illuminate the battlefield during the hours of darkness.

(2) Flame field expedients emplaced in likely avenues of approach will delay the enemy and help to canalize his attack. This emplacement applies particularly to small defiles that cannot be blocked by flat trajectory fire or that may be too numerous for the number of final protective fires allotted. To block these approaches properly, flame field expedients should be positioned in depth so that the farthest one forward may be fired without igniting the next one.

(3) Flame devices may be located immediately forward of reserve platoons and companies in likely areas of penetration. In placing these weapons, care must be taken for safety of friendly troops and positions.

(4) Flame field expedients are valuable in the defense of rear area installations. In addition to their demoralizing and casualty-producing effects, they provide illumination. Semipermanent installations may have many emplaced flame field expedients arranged so that they may be fired by one man.

c. In Retrograde Movements. In these movements, improvised flame mines may be left on or near roads to destroy the leading elements of enemy pursuit forces and to delay succeeding pursuers.

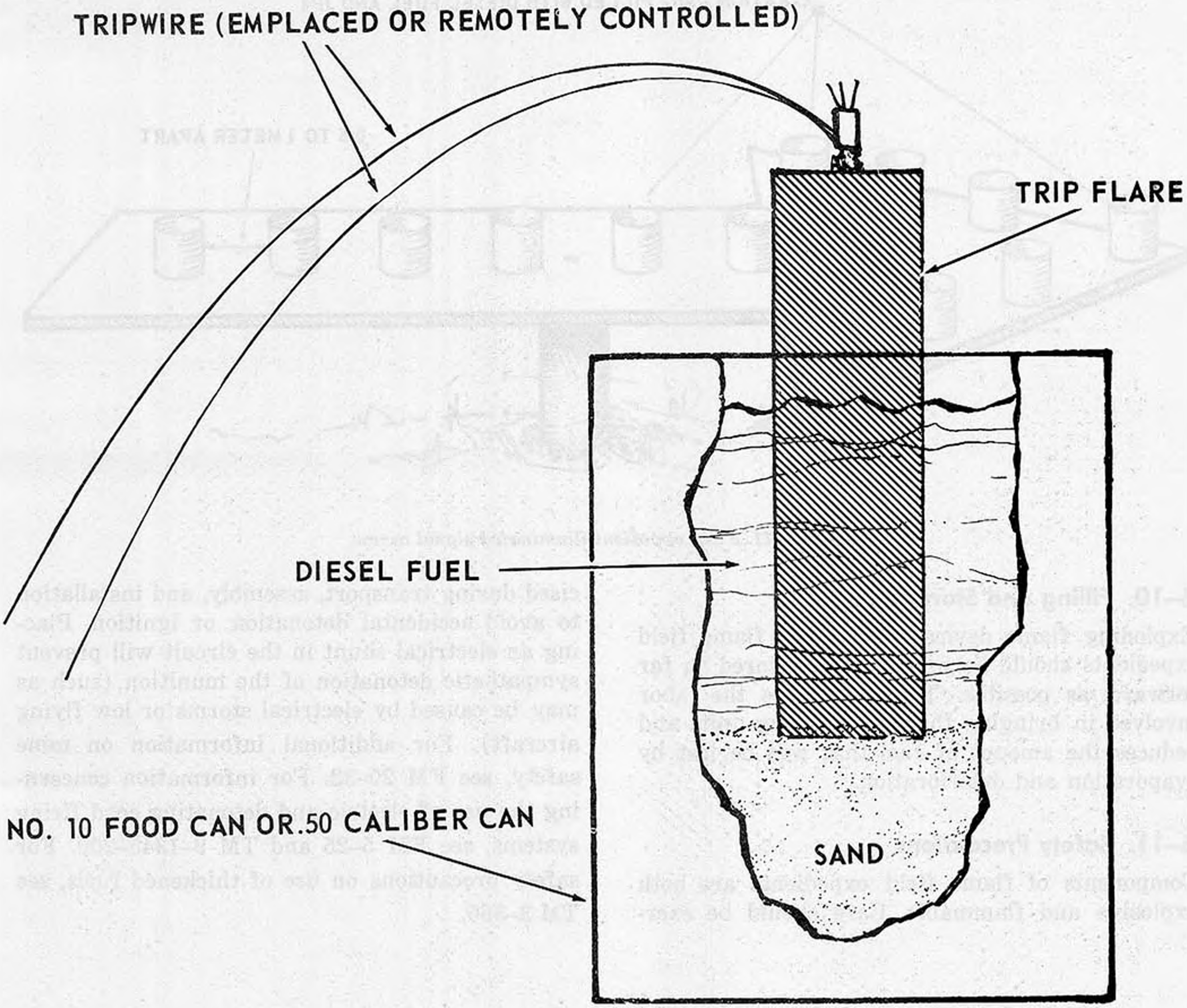

TRIPWIRE (EMPLACED OR REMOTELY CONTROLLED)
TRIP FLARE
DIESEL FUEL
NO. 10 FOOD CAN OR .50 CALIBER CAN
SAND

Figure 6–10. Field expedient illuminator.

6–9. Requirements for Installation

Emplaced flame devices should be —

a. Within the perimeter defense barrier and, whenever possible, be covered by supporting fire to prevent destruction or removal by the enemy.

b. In the field of observation of the man assigned to fire them.

c. Completely wired in, marked, recorded, and reported when used as part of the mine defense plan.

d. Irregular in layout and not easily disclosed so that the enemy cannot determine the pattern.

e. Concealed from hostile ground and air observation to maintain surprise and minimize destruction by enemy long-range weapons. They should be sited for maximum protection from fire.

f. Compatible with natural obstacles and arranged to obtain overlapping flame dispersion that cannot be bypassed or outflanked.

g. Coordinated with other elements of the defense in the planned fire support.

h. Used in sufficient numbers to be effective for the purpose intended.

i. Planned to permit the passage of friendly patrols and vehicles.

j. Checked periodically to make certain that the firing system is functional and the explosives and fuel have not deteriorated.

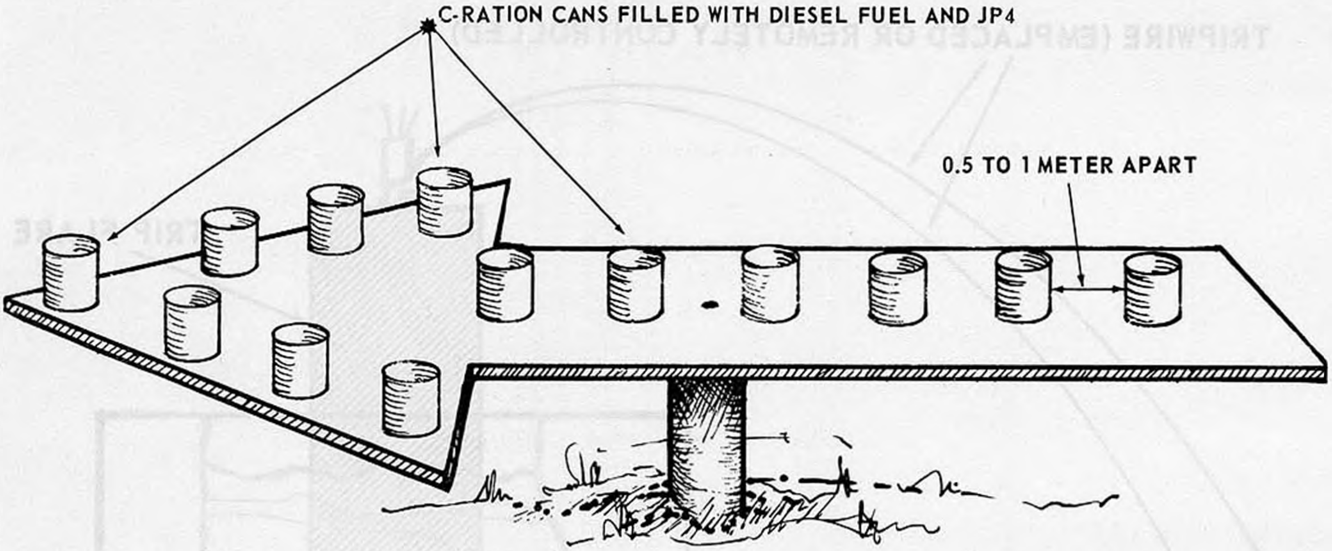


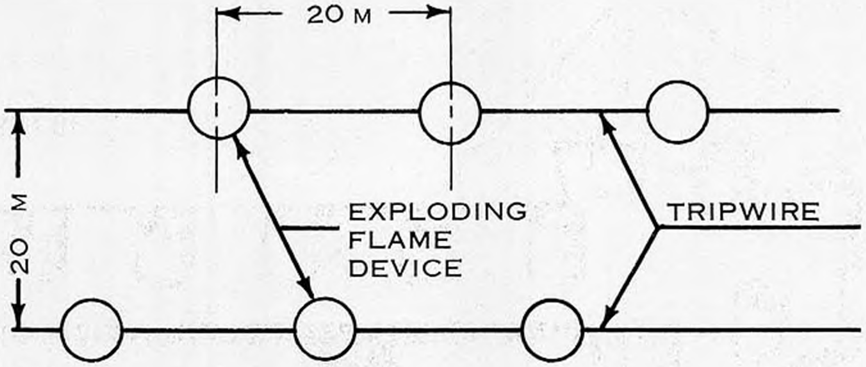
Figure 6-11. Field expedient illuminated signal arrow.

6-10. Filling and Storage

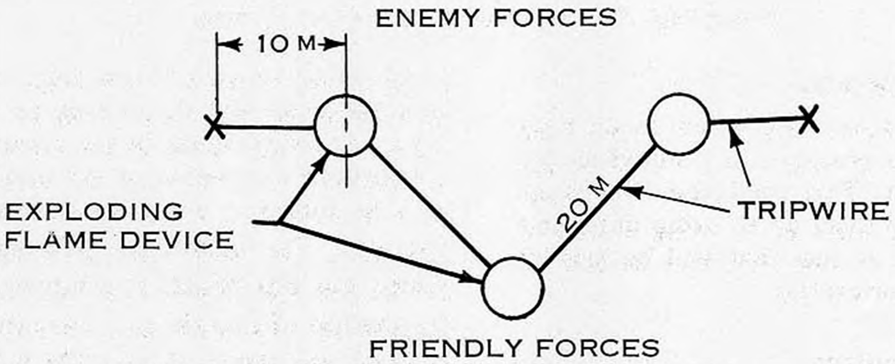
Exploding flame devices and other flame field expedients should be prepared and stored as far forward as possible. This minimizes the labor involved in bringing them up to using units and reduces the amount of fuel that will be lost by evaporation and deterioration.

6-11. Safety Precautions

Components of flame field expedients are both explosive and flammable. Care should be exercised during transport, assembly, and installation to avoid accidental detonation or ignition. Placing an electrical shunt in the circuit will prevent sympathetic detonation of the munition (such as may be caused by electrical storms or low flying aircraft). For additional information on mine safety, see FM 20-32. For information concerning the use of electric and detonating cord firing systems, see FM 5-25 and TM 9-1345-200. For safety precautions on use of thickened fuels, see TM 3-366.


20 M
20 M
EXPLODING
FLAME
DEVICE
TRIPWIRE

PARALLEL EMPLACEMENT


ENEMY FORCES
10 M
EXPLODING
FLAME DEVICE
20 M
TRIPWIRE
FRIENDLY FORCES

TRIANGLE EMPLACEMENT

NOTE:

BECAUSE THERE ARE BUT 51M OF TRIPWIRE ISSUED WITH FIVE OF THE FUZES, WHERE 93M ARE REQUIRED FOR PROPER EMPLACEMENT OF FIVE UNITS, SUBSTITUTE MATERIAL FOR TRIPWIRES MUST BE USED. IT IS SUGGESTED THAT TELEPHONE WIRE BE USED BECAUSE OF ITS DARK COLOR, AVAILABILITY, AND CASUAL APPEARANCE. TELEPHONE WIRE MAY ALSO BE USED AS A LANYARD ATTACHED TO THE TRIPWIRE AND RUN BACK TO A FIRING BUNKER.

Figure 6–12. Useful nonstandard emplacement patterns for improvised 5-gallon flame field expedients.

CHAPTER 7

AIR FLAME OPERATIONS

7–1. General

This chapter provides personnel engaged in planning air support operations with information necessary to request the integration of air flame weapons with ground operations. These fire-producing munitions, properly used, can inflict great damage.

7–2. Types of Weapons

Air flame weapons consist of two types: firebombs and incendiary bombs. Firebombs are used primarily by elements of the tactical air force to support ground operations. Incendiary bombs are generally used by the strategic air force to attack strategic or deep targets thay may affect ground operations. The tactical air force may also deliver incendiary bombs. Firebombs and incendiary bombs are described below.

a. Firebomb. The firebomb (fig 7–1) is a cigar-shaped, thin-casing tank filled with thickened gasoline. When assembled and ready for use, it consists of the tank, two igniters, two fuzes, and an arming system. Fighter, fighter-bomber, and other aircraft may carry from two to eleven bombs under the wings. On impact, the bomb produces a fireball (fig 7–2) and spreads thickened fuel over an elliptical area that varies with the speed of delivery and size of the bomb. The fireball is usually of short duration, about 5 seconds, with intense heat; the fuel may burn about 5 minutes, depending upon the type of impact, with reducing intensity. Secondary fires may be started in the area. Firebombs in the following sizes are available:

Size (pounds)	Capacity (gallons)	Expected burn pattern (meters)
750	100/110	122 x 23
500	65/75	61 x 24
250	38	53 x 26

b. Incendiary Bomb. An incendiary bomb is a cluster of small bomblets that contain incendiary material (fig 7–3). The cluster opens at a predetermined altitude to spread the bomblets over the target area to start a number of individual fires. The size and weight of the bomblet affect its ability to penetrate a target and determine what type cluster is selected to attack a specified target. The bomblets may contain thermate, magnesium, or an oil and metal incendiary mixture.

7–3. Firebomb Targets and Effects

a. Targets. The following are suitable targets for firebombs:

(1) Concentrations of troops in the open, stationary, or on the march.

(2) Vehicles, including armor in vulnerable posture.

(3) Weapon positions, including missile launching sites.

(4) Supply or equipment concentrations.

(5) Command posts.

(6) Closely defended roadblocks.

(7) Fortifications or strongpoints.

(8) Air warning and radar installations.

(9) Airfields and aircraft.

(10) Bridges and tunnels occupied by personnel.

b. Effects. Although firebombs do not have the great explosive and fragmentation effects of HE bombs, they do produce similar effects to some degree (fig 7–4). When a firebomb hits the target, it is traveling only slightly slower than the aircraft because of the low altitude of release. The shattering impact of the bomb on the target may produce some incidental fragmentation effects; however, the impact of the flame fuel on the target can produce structural damage.

(1) *Personnel.* Unprotected personnel are extremely vulnerable to firebomb attacks; however, those within a shelter such as a bunker, cave, or pillbox could possible survive. Personnel in armored vehicles may become casualties if the burning fuel is drawn into or leaks into these vehicles. Casualty effects upon protected

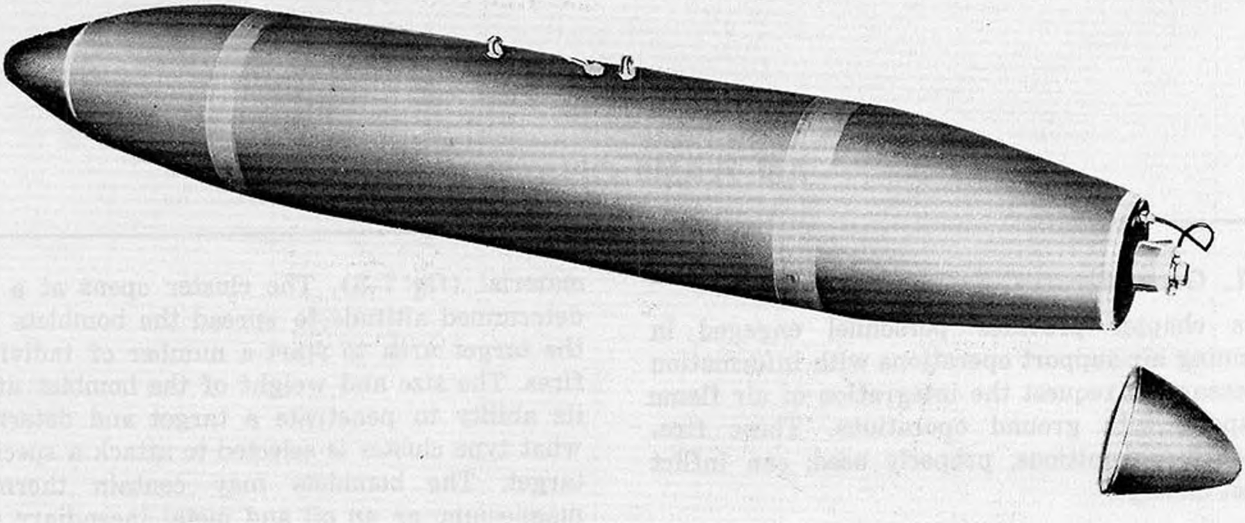


Figure 7-1. BLU/C/B 750-pound firebomb.

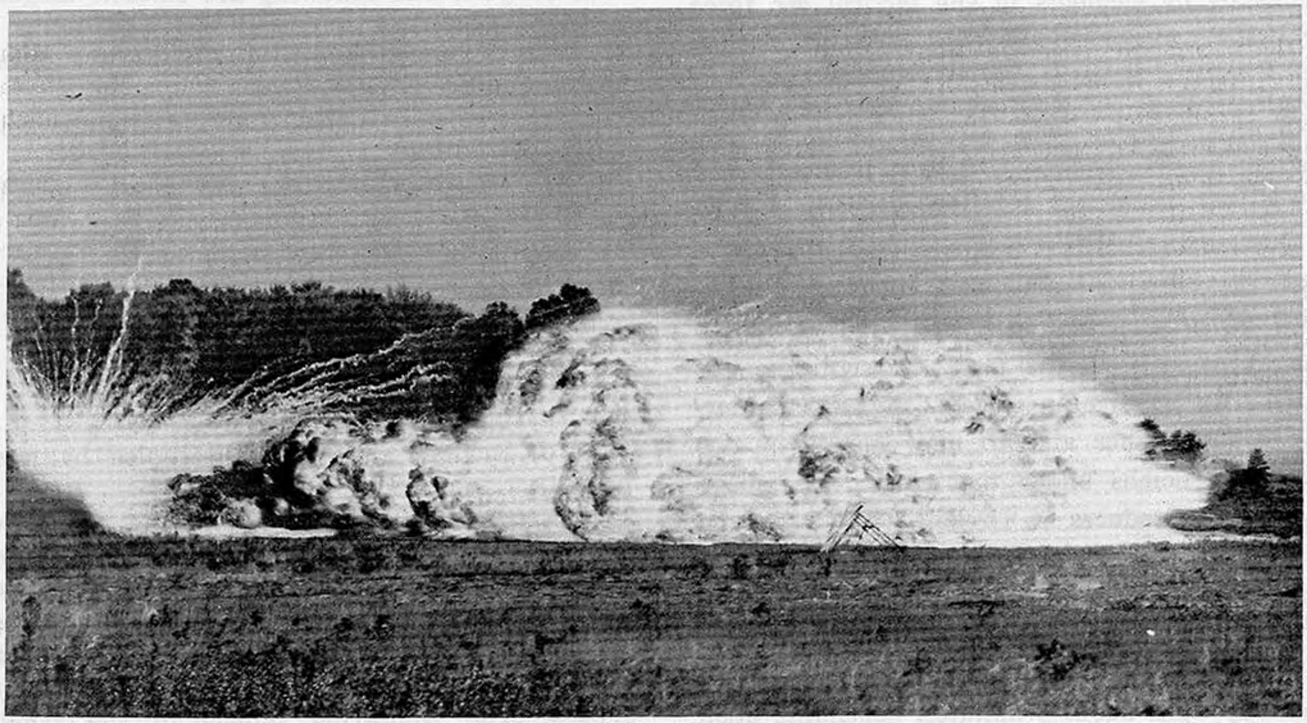


Figure 7-2. Detonated firebomb.

personnel will be confined mostly to suffocation due to lack of oxygen and the phychological impact brought on by man's fear of fire.

(2) *Vehicles and weapons.* Firebombs can be effective against enemy vehicles, weapons, and armor in vulnerable posture. The ability of the thickened fuel to cling to the target and continue to burn can produce damaging effects upon the target for prolonged periods of time following the actual attack.

(3) *Structures.* Firebombs are effective against many types of buildings. They are not effective against reinforced concrete buildings. They have limited effect on tunnels, most

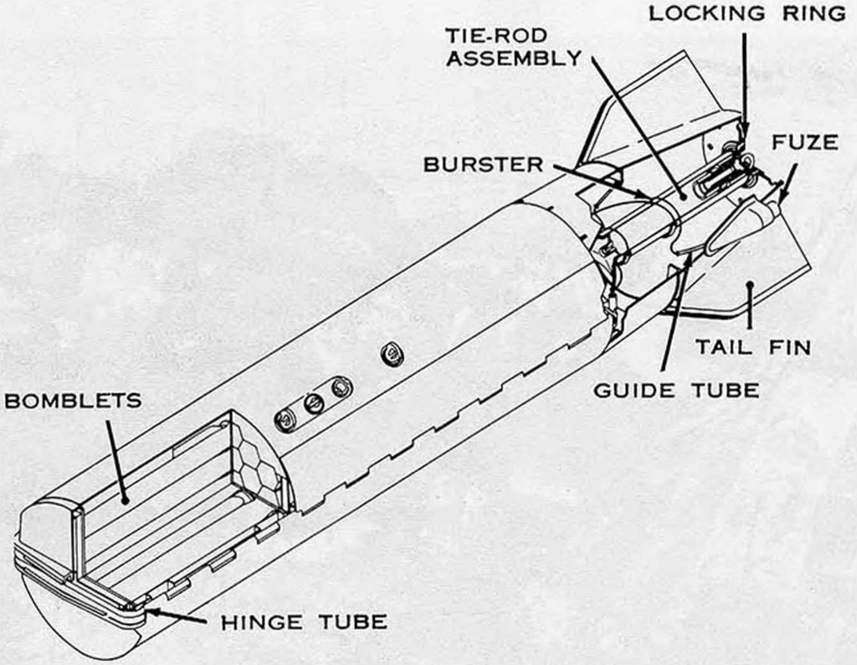


Figure 7–3. M74-type incendiary bombs, 57 10-pound bomblets in M35 cluster.

bridges, and fortified positions, although they can effectively neutralize personnel occupying these positions. Firebombs delivered by high speed aircraft can produce structural damage to fortifications and buildings. This damage is caused by the impact of the liquid fuel on the target rather than by the burning fuel. Lightly built dwellings and factories in some theaters make excellent firebomb targets. Most of these buildings are made of wood, plaster, and straw, which burn easily.

(4) *Aircraft and air installations.* Firebombs will set fire to combustible parts, oil supplies, and material at air installations. Radar and radio equipment can be burned and damaged by the heat.

(5) *Noncombustibles.* Machinery and tools that are not combustible can be twisted out of shape by the heat or have their temper destroyed.

(6) *Asphalt and other composition materials.* Firebombs will set fire to asphalt, nylon, rayon, and similar materials.

7–4. Incendiary Bomb Targets and Effects

a. Targets. Incendiaries may be used with other type munitions employed in air attacks. The following are suitable targets for incendiary bomb attacks in support of ground operations:

(1) Troops and weapons located in a combustible area.

(2) Shelters, vehicles, or supplies of a combustible nature or located in a combustible area.

(3) Airfields, aircraft, and missile launching sites.

(4) Facilities that support enemy operations. These targets may be tactical or strategic in nature and include supply installations, factories, repair facilities, docks and shipping facilities, powerplants, mines, railroad facilities, urban areas, and communications centers.

b. Effects.

(1) *Structures.* Wooden structures are naturally more vulnerable to incendiary bomb attack than other more durable materials such as concrete, steel, or stone. When incendiary bombs are employed against built-up areas, they may cause secondary fires. Unless these secondary fires are controlled, they may result in the creation of a fire storm. In buildings partially constructed of steel or concrete, primary fires are difficult to start unless the contents of the buildings are flammable. Even though the contents of the building may be flammable, the opportunity for fire to spread is severely limited. Nevertheless, if the flammable contents of steel structures are ignited, enough heat may be generated to warp and bend the metallic structures and in some cases to melt the metal. Extreme heat causes concrete and stone to crack or break. In extreme heat, mortar disintegrates and may cause brick or masonry construction to crumble.

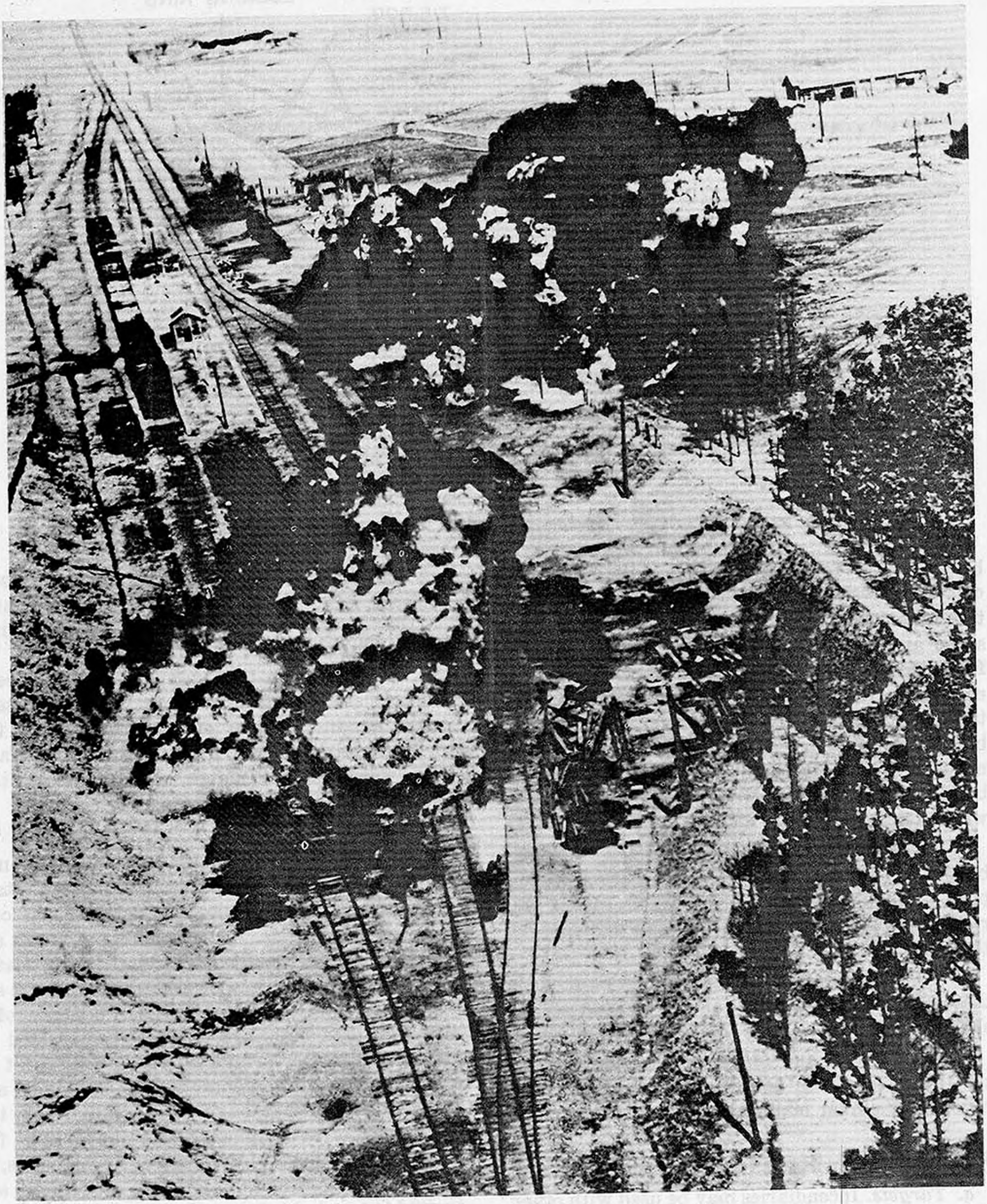


Figure 7–4. Effects of a firebomb attack.

(2) *Personnel.* To be effective as antipersonnel weapons, incendiary bombs must be used in sufficient quantities to overcome existing fire defense measures. Therefore, the object is to surround the personnel with a "wall of fire" to create intense heat and to exhaust oxygen supplies in inclosed spaces. Area bombing must be used to accomplish this. In contrast, precision bombing is used if the target is purely industrial in nature. Incendiary bombing in the open is not practical except against massed personnel. In this situation, mass use and surprise are the two most important considerations.

7-5. Target Analysis

Target analysis to determine the vulnerability of a target to firebomb or incendiary bomb attack is a function of the fire support element. The analysis includes a consideration of weather, terrain, combustibility of the target, penetrability of the target, and fire-reducing factors in the target area (to include fire defense). The target analysis results in the selection of the proper munition to achieve the desired effects. The Air Force determines the method of delivering the munitions. Army personnel engaged in air support operations recommend targets whose destruction or damage will assist ground operations.

7-6. Principles of Employment of Air Flame Weapons

a. Firebombs. The employment of firebombs conforms to the general principles governing the use of any air munition. The target must be vulnerable whether the bombs are used in support of offensive or defensive operations. Firebombs can be effective in the defense to repal enemy mass attack.

(1) *Surprise.* Firebomb strikes are more effective if delivered unexpectedly when the enemy is least prepared for the attack or countermeasure. Information pertaining to flame capability of air support elements should be kept from the enemy.

(2) *Mass.* The number of bombs used must be sufficient to complete the mission. When firebombs are used in support of defensive ground operations, mass delivery of them on attacking troops can disrupt the attack.

(3) *Coordination.* Coordination of firebomb missions with friendly troop commanders is mandatory.

(4) *Simplicity.* Plans and orders for the employment of firebombs should be as simple as possible to reduce misunderstanding and confusion.

b. Incendiary Bombs. The employment of incendiaries should conform to the general principles governing the use of any air munition. Consideration must be given to the flammability of the target and its contents, the amount of ammunition required to insure effective saturation of the target area, the effectiveness of fire defense measures and methods of combating those measures, and the probable losses of friendly aircraft to antiaircraft fire and fighter interceptors.

(1) *Surprise.* Every effort should be made to strike when the enemy is least prepared. Information concerning flight courses and bombing altitudes must be denied the enemy.

(2) *Mass.* The number of bombs used on the target must be sufficient to effectively complete the mission.

(3) *Coordination.* Normally, on a strategic mission, coordination with allies is required; on a tactical mission, coordination with friendly troop commanders is mandatory.

(4) *Simplicity.* Plans and orders for the employment of incendiaries should be as simple as possible to reduce misunderstanding and confusion.

7-7. Objectives

The basic objective of firebombs and incendiary bombs in tactical operations is to kill, injure, neutralize, and demoralize. A secondary but extremely important objective is to destroy or damage materiel and facilities.

7-8. Bombing Techniques

a. Firebombs. Firebombs employed in close support are delivered by visual strike methods. The angle and speed of drop tend to impart a flamethrower effect to the bomb. Radar and other electronic techniques may be used where safety conditions permit.

b. Incendiary Bombs. Incendiary bombs used in support of ground operations may be delivered by the low altitude bomb aiming systems (LABS) technique, by electronic control means, by visual techniques, or by high altitude bombers.

7–9. Air Requests

Requests for air flame weapons are processed through the Army air-ground system for preplanned targets or through the US Air Force tactical air control system for immediate targets. See FM 100–26 for additional information on the air-ground operations system.

7–10. Target Designation

Targets must be accurately located and described so that a determination can be made of the force, armament, and equipment required. The priority of the target is also indicated.

7–11. Coordination

Information concerning a planned air attack must be coordinated and disseminated. The air attack plan is coordinated with ground fires and with the plan of maneuver. When used in joint operations, ground and air forces function as components of a single team in planning and executing the mission. This coordination includes safety measures for friendly aircraft and troops and must extend through all echelons of the air-ground operation. Firebomb attacks in conjunction with ground troop assaults must be carefully timed, coordinated, and controlled.

7–12. Exploitation of Air Attack

The duration of effects of air flame attack is relatively short. Ground forces must aggressively exploit these effects according to the planned scheme of maneuver.

7–13. Army Aviation Delivery of Flame Field Expedients

a. General. Army helicopters can be used effectively to deliver flame field expedients. Many devices can be prepared, the limitation being the imagination of the personnel preparing them. Two methods used successfully for the delivery of 55-gallon drums are the sling-loaded cloverleaf and cargo-net loads. Both methods are extremely responsive to the needs of the ground commander when these loads are prepackaged and prepositioned in the area of operations. Any utility or cargo helicopter can be diverted to pickup points and can deliver flame expedients on target within minutes, whereas conventional delivery methods sometimes require several hours.

(1) Sling-loaded cloverleaf. Tie two 55-gallon drums of aviation gas (AVGAS) together with one drum of JP–4 fuel. Attach standard sling for external loading. Affix one or more thermate grenades (or trip flares) to each drum with tripwires attached to another drum. Airlift by helicopter to target area and drop on target from sufficient altitude to guarantee drum breakage on impact and drum separation in order to ignite the grenades. Upon impact, the drums will break open and spill fuel, mixing the AVGAS and JP–4 on the ground. Separation of any one of the drums from the bundle will cause at least one grenade to ignite. Failure to separate and ignite can be overcome by firing tracer ammunition, rockets, 40-mm grenades, or any other explosive ordnance into the fuel.

(2) *Cargo-net load.* Place up to twenty 55-gallon drums of thickened fuel in a cargo net. Affix one end of the net to the aircraft, and the other end to the cargo hook. From altitude and while in a near-hover condition, center the aircraft over the target and release the cargo hook. The drums will saturate the target area with "wet" fuel upon impact. Ignition is accomplished by ground personnel, by thermate grenades from the drop aircraft, or by air-delivered ordnance from an escort aircraft. This is a safe method in that flame munitions dropped too close to friendly troops do not have to be ignited until the troops are withdrawn to a safe distance. In this case ignition is the responsibility of the ground commander.

b. Emplacement of Flame Devices. In a defensive position, Army aircraft can be used effectively to expedite emplacement of flame devices which are (because of weight or mass) too cumbersome for easy handling by men on foot or in vehicles. Flame field expedient devices, such as shown in chapter 6, can easily be loaded externally and carried to preselected sites for emplacement.

7–14. Safety

Measures must be taken to protect friendly aircraft and troops. Targets must be properly identified before they are attacked. Ground force commanders coordinate these attacks through advice and assistance of the air liaison officer of their headquarters or through forward air control teams. Any one or a combination of the control methods listed in *b* below will assist pilots in close support fire bombing.

a. Safety for friendly aircraft can be accomplished by the use of electronic identification devices, identification and recognition training, and radio authentication codes, and by the use of proper methods of engaging the target.

b. Safety for friendly ground troops includes–

(1) Control provided by the tactical air control party.

(2) Reference to grids or coordinates on photographs or maps.

(3) Reference to nearby landmarks or terrain features readily discernible to the pilot.

(4) Use of radar or electronic guidance equipment available through the Air Force tactical air control system.

(5) Use of spotter aircraft to designate the target.

(6) Use of any one or a combination of the above methods to guide an airborne forward air controller to the target, who, in turn, directs attacking aircraft to the target.

(7) Use of white or colored smoke shells when firing artillery or mortars.

(8) Use of artillery or mortar illuminating shells at night.

(9) Use of colored panels or colored smoke grenades to assist in the guidance of attacking aircraft into the target area and to identify friendly positions.

CHAPTER 8

DEFENSE AGAINST FLAME

8–1. General

Troops must be made to understand that the individual soldier can protect himself from flame. The most effective individual defense is to keep particles of burning fuel off the person by means of cover. Items of individual equipment offer protection against burning fuel. Foxholes and weapon positions can be modified to afford protection against any flame attack except a direct hit by a firebomb. The application of proper individual measures plus aggressive unit defenses can make an enemy flame attack relatively ineffective.

8–2. Individual Protection

Individuals should be instructed to —

a. Use any available cover when a flame attack appears imminent. Foxholes and prepared positions are the most satisfactory, but shell holes and small depressions assist in reducing the hazards of burning fuel and offer some protection. If time permits, overhead cover should be used. A field jacket pulled up over the head and covering any exposed skin (such as face, neck, or hands) offers some protection against direct burns.

b. Remain covered with no skin exposed until after the flame bomb has burst in the vicinity and then throw off the cover and remove any burning particles from their clothing.

c. Use any of the following items of equipment for protection against burning fuel:

(1) Two thicknesses of the shelter half will hold burning fuel for more than 10 seconds.

(2) The field jacket and issue blanket offer almost the same protection when used as foxhole covers.

(3) Tent canvas and truck tarpaulins that have been treated with fire-resistant material will withstand direct hits with burning fuel and will hold the burning particles for a sufficient time (more than 30 seconds) to permit personnel to escape from the foxhole.

d. Use foxhole covers improvised of brush and with as little as 2 inches of earth on top, which will successfully withstand burning fuel.

Warning: **The plastic or rubber-coated poncho should not be used as overhead cover because it will melt and adhere to the skin, causing injury or burns.**

8–3. Training

a. Through troop indoctrination in the enemy's flame capabilities and limitations is essential. Proper mental conditioning, which leaves the individual soldier with the conviction that ground flame attacks can be repulsed, is the primary consideration in teaching defensive tactics. Commanders responsible for the training of troops must continually emphasize the difficulties the enemy will encounter in carrying out successful flame missions.

b. Stress is placed on the following:

(1) The amount of coordination required by the enemy to prepare for an attack.

(2) The difficulties of maintaining the initiative and the probable lack of control during the attack.

(3) Limitations of the flame weapon.

(4) Susceptibility to failure of the entire flame threat through destruction of key personnel or vehicles before they reach firing range.

(5) The high degree of accuracy necessary against small, well-camouflaged ports, even if the gunner should reach an assaulting position.

c. Troops must be trained to recognize enemy flame equipment and to recognize any indications that the enemy is preparing for a flame attack. Training also includes the enemy's technique of flame employment. Troops are alerted to preparations the enemy may make before the flame attack. By knowing these, friendly troops can anticipate the attack and prepare to defend against it.

8-4. Troop Attitude

a. The troop attitude is a paramount factor in the successful repulsion of a flame attack. A determined troop effort that incorporates a calm, calculating, and aggressive attitude is needed to destroy the flame threat.

b. One of the greatest dangers of a firebomb attack is its psychological impact, which may demoralize troops and cause them to defend their positions inadequately. Troops should be trained in defensive measures against firebomb attacks. These include the same measures prescribed for defense against other forms of air attack.

8-5. Mutually Supporting Defensive Positions

a. The best defense against both portable and mechanized flamethrower attacks is offensive action. Flamethrowers and their operating personnel should be destroyed before they get within effective range of their intended target. Mutually supporting defensive positions offer substantial assurance that this objective can be attained. Commanders responsible for the organization of defensive positions must pay particular attention to terrain in defilade of each position and to positions that offer some concealment from the attack. Positions in defilade often prove to be the best avenues of approach for the flamethrower gunner. Defending personnel should be warned that the attacker may prepare cover and concealment by using smoke or by using artillery or mortars to create shell craters leading to his selected assault positions.

b. After it has been definitely established that a flame attack is about to be or has been launched, all personnel should be notified to fire on the attacking flamethrowers when they are within range. Reconnaissance by fires of supporting weapons can be effective in deterring te flame attack only if the general area of the flamethrower is known.

c. Personnel in foxholes, slit trenches, and other positions located near the intended target can be used effectively against a flamethrower attack. After the preliminary bombardment and when the flamethrowers come within range, these personnel must act quickly with rifle fire, grenades, or antitank weapons.

d. At the time of the actual flame attack, personnel under attack must take cover in available shelter. If caught in the open (with no shelter immediately available), troops are best protected by running at right angles to the direction of fire or at right angles to the direction of flight of the attacking planes.

8-6. Use of Supporting Fires

Supporting artillery and mortars and supporting air should be informed immediately of the location of enemy flame weapons. Destruction of these weapons has high priority in the fire plans of direct support artillery and mortars. Reinforcing artillery and mortar fires should be called for when large numbers of enemy weapons are participating in the attack. The maximum rate of fire is maintained (when the target is a mechanized flamethrower) until the threat of the attack is eliminated. Precision adjustment for the complete destruction of the flamethrower should follow when the vehicle is only damaged.

8-7. Passive Defense Measures

The best passive defense measure against flame is a foxhole or other shelter with overhead cover. The effectiveness of shelters against flame can be improved by the steps outlined below. They should be accomplished as the tactical situation and time permit.

a. Barriers. Artificial barriers (such as doors, false walls, or curtains) or natural barriers (such as curving passageways in caves or tunnels, side pockets, or protruding rock formations) within fortifications provide protection against ricocheting blobs of flame fuel, the blast of flame, and hot gases. In foxholes and fortifications, blankets or shelter halves afford some protection, particularly if they are wet and are used to cover the position or entrances to it. Standard clothing and sleeping equipment also offer some personal protection.

b. Ventilation. Casualty effects of flame are reduced in well-ventilated positions. Commanders must decide whether to prescribe additional ventilation based on the possibility of flame attack as compared to attack by small arms, grenades, and other weapons. Holes may be opened in houses or basements by blasting; holes may have to be provided in deliberate fortifications. Increased ventilation does not prevent the temporary neutralization of the position while it is under flame attack.

c. Camouflage and Dispersion. Despite the value of individual cover, camouflage and dispersion are also important elements in the defense against flame. The defense against flame attacks is strengthened by—

(1) Selecting positions that do not possess obvious natural or isolated features.

(2) Dispersing the unit within the selected position.

(3) Using dummy positions to confuse the enemy as to the true target.

(4) Enforcing proper camouflage discipline, to make difficult the enemy selection of aiming points.

8–8. First Aid

The first-aid treatment of burns and shock, as currently taught to combat personnel, applies in the treatment of flame casualties. The emergency measures for the treatment of personnel suffering from carbon monoxide poisoning and lack of oxygen are fresh air and resuscitation.

APPENDIX A

REFERENCES

A–1. Army Regulations (AR)

310–25	Dictionary of United States Army Terms.
310–50	Authorized Abbreviations and Brevity Codes.
385–63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.

A–2. Field Manuals (FM)

5–25	Explosives and Demolitions.
5–31	Boobytraps.
7–11	Rifle Company, Infantry, Airborne, and Mechanized.
20–32	Landmine Warfare.
20–60	Battlefield Illumination.
31–25	Desert Operations.
31–50	Combat in Fortified and Built-Up Areas.
31–71	Northern Operations.
31–75 (Test)	Riverine Operations.
100–26	The Air-Ground Operations System.

A–3. Technical Manuals (TM)

3–366	Flame Fuels.
3–1040–204–14	Organizational, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tool Lists): Flamethrower, Portable, M2A1–7.
3–1040–206-series	Flame Thrower, Mechanized, Main Armament, Turret-Mounted, M7A1–6.
3–1040–209–12	Organizational Maintenance Manual: Flame Thrower, Mechanized, Main Armament, M10–8.
3–1040–219–12	Organizational Maintenance Manual: Service Unit, Flame Thrower, Truck-Mounted, M4A2(D) and Service Unit, Flame Thrower, Truck-Mounted, M4A2(IR) (DAVEY) FSN 1040–740–1152 (INGERSOLL-RAND) FSN 1040–740–1150.
3–1040–256–12	Operator and Organizational Maintenance Manual: Service Unit, Flamethrower, Tracked-Vehicle Mounted, XM45E1.
3–1040–257–12	Operator and Organizational Maintenance Manual: Flame Thrower, Portable, M9E1–7.
3–1055–218–12	Operator's and Organizational Maintenance Manual: Launcher, Rocket: 66mm, Four-Tube, XM202.
9–1345–200	Land Mines.

A–4. Tables of Organization and Equipment (TOE)

3–32	Headquarters and Headquarters Detachment, Chemical Group.
3–266	Headquarters and Headquarters Detachment, Chemical Smoke Generator Battalion.
3–357	Chemical Mechanized Flame Company.
3–500	Chemical Service Organization.

A-5. Miscellaneous

ASubjScd 3-3	Employment of Smoke and Flame.
ASubjScd 3-10	Portable Flamethrower Training.
DA Pam 310-1	Index of Administrative Publications.
DA Pam 310-3	Index of Doctrinal, Training, and Organizational Publications.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.

APPENDIX B
PORTABLE FLAMETHROWER GUNNERY

Section I. TRAINING

B-1. General

a. Before firing a portable flamethrower, a soldier must receive certain preliminary training. He should have at least a general knowledge of the functioning of the weapon and be familiar with the servicing and maintenance procedures involved in preparing it for use. He must understand the firing procedure for the particular type of flamethrower he will be firing as well as the correct principles of aiming and positions. He should be familiar with all safety features of the weapon and with safety precautions to be taken before, during, and after firing.

b. Schedules and lesson outlines for training portable flamethrower gunners are described in Army Subject Schedules 3–3 and 3–10. Details of functioning, servicing, and maintenance are described in the technical manuals pertaining to the particular type of portable flamethrower. Fuel mixing and evaluation are described in TM 3–366. Safety precautions and firing ranges are discussed in AR 385–63.

c. Although the procedures discussed in the following paragraphs of this appendix are for the M2A1–7 portable flamethrower, the principles involved are also applicable to the M9–7 and M9E1–7 portable flamethrowers.

B-2. Firing Procedure for the M2A1–7 Portable Flamethrower

a. Adjusting the Carrier. Before beginning a flame mission, insure that the carrier is adjusted so that the tank group will ride as comfortably as possible on your back. Check to see that the lacing which holds the carrier to the tank group is tight enough to keep the metal tank group from irritating your back. Adjust the shoulder straps so that the tank group rides high, but not so tight that they restrict blood circulation in your arms. The body strap should be tight enough to prevent the tank group from bouncing excessively when you run. Check to see that the quick releasing fasteners function properly.

b. Placing the Flamethrower on the Back. If there is someone nearby to help, have him lift the flamethrower while you put your arms into the straps. If there is no one to help, place the flamethrower upright on the ground, sit down with your back against the carrier, and then put your arms into the straps. To get up, hold the gun group by the barrel with your right hand and roll over on your left knee, pushing up with your left hand. Be careful that you do not accidentally squeeze either the trigger or the fuel valve lever.

c. Opening the Pressure Tank Valve. The pressure tank valve controls the flow of pressure from the pressure tank to the fuel tanks. This valve should be opened *slowly* to lessen the possibility of malfunction and in combat situations should be opened before the gunner gets within hearing range of the enemy, since the compressed air or nitrogen makes a hissing sound when it flows into the fuel tanks. However, the valve should not be opened too soon, because the compressed air or nitrogen may drain off through small leaks in the pressure system. Open the pressure valve all the way to allow the compressed air or nitrogen to flow to the fuel tanks easily. Wait until the hissing sound stops before attempting to fire the flamethrower.

d. Firing.

(1) *Controlling the fuel.* The fuel is controlled by the fuel valve lever. In order to operate this lever, depress the valve safety lever at the same time. The ignition grip of the M7 gun group can be rotated, thus enabling it to be adjusted to suit the gunner. Be sure to depress the fuel valve lever all the way or else the fuel may not escape from the gun with sufficient force to reach the target. Release the fuel valve lever as soon as the fuel is exhausted. You can

tell when the fuel is exhausted by a definite change of sound.

(2) *Controlling the ignition.* Fuel ignition is controlled by the ignition lever. On the M7 gun group, you cannot depress the ignition lever unless you depress the ignition safety lever at the same time. Several techniques are used to ignite the fuel. You may desire to wet the target with fuel before you ignite it. In this case, first depress the fuel valve lever, allowing the unignited fuel to go to the target. Then ignite the fuel by firing an ignited burst at the target. Normally, you will depress the ignition lever first and then the fuel valve lever one or two seconds later to ignite and project the fuel to the target. There are five charges in the ignition cylinder. Each of these charges will burn for 8 to 12 seconds. In very cold weather or when using a poor grade of fuel, it may be necessary to use two or more charges at the same time in order to ignite the fuel. This can be accomplished by depressing the ignition lever, releasing it, and depressing it again for each additional charge which the gunner wishes to fire from the ignition cylinder.

e. Post-Firing Actions.

(1) *Remove the ignition cylinder.* After the firing mission is completed, remove the ignition cylinder in the following sequence:

(*a*) Point the gun at the ground until the ignition shield has cooled.

(*b*) Press the nozzle shield latch.

(*c*) Unscrew the nozzle shield and allow the ignition cylinder to fall out. (Care must be taken to keep the hands away from the front of the cylinder.)

(*d*) Save partly used cylinders for future use or expend them by firing them from the gun after the fuel tanks have been emptied.

(2) *Close the pressure tank valve.* If additional shots are to be fired before refilling or recharging, close the pressure tank valve by turning the valve handle clockwise to conserve remaining pressure.

(3) *Release the pressure in the pressure tank.* If no additional shots are to be fired before refilling and recharging, open the pressure tank valve by turning the handle counterclockwise. Point the gun in a safe direction and blow out the remaining fuel and pressure by squeezing the fuel valve lever and valve safety lever until there is no further discharge. (Do not use the ignition lever during this operation.) Then close the pressure tank valve to keep foreign matter out of the pressure system.

(4) *Remove the tank group.* Carefully remove the tank group from your back. This may be done more easily by sitting or squatting with your back to a tree stump, flat rock, packing box, or other object; releasing the body and shoulder straps; and easing the tank group from the back. Avoid dropping equipment as this may damage it.

(5) *Open the bleeder valves.* After you remove the tank group, open both bleeder valves to make certain that there will be no further buildup of pressure in the fuel tanks. Unless you open these valves, the pressure may build up because of a leaking pressure tank valve or because of the heating and expansion of air inside the fuel tanks. (To bleed pressure from the M9E1-7 flamethrower, turn fuel tanks upside down—resting on plastic cover—and bleed pressure through the gun.)

***Caution:* Do not disconnect the gun group from the tank group while there is pressure in the fuel tanks.**

(6) *Perform after-firing maintenance.* Inspect, clean, and service the flamethrower as described in TM 3-1040-204-14 for after-firing maintenance.

B-3. Positions

a. General. You can fire the flamethrower from any position that permits sufficient freedom to aim the weapon, subject to the following conditions:

(1) During firing, the bottoms of the fuel tanks must always be substantially lower than the tops. Tanks must not be tilted to either side; otherwise, only a small part of the fuel will be blown from the tanks.

(2) Stability must be sufficient to withstand the recoil from the gun.

(3) Full advantage should be taken of such cover and concealment as shell craters and vegetation.

b. Standing Position. The portable flamethrower is most often fired from the standing position (fig B-1). To assume the standing position, grasp the fuel valve lever grip with your right hand and the ignition lever and ignition safety lever with your left hand. Face the target and execute a half right face; then step toward the target with your left foot so that your feet are a comfortable distance apart and your left foot is pointed in the general direction of the target. Lean forward slightly and press your right elbow against your side to brace against the recoil. Keep the gun about waist high and your head up so that you can watch the target.

c. Kneeling Position. Use the kneeling position (fig B–2) when you do not expect to move to a different firing location rapidly and you desire to minimize exposure to the enemy. To assume the kneeling position, grip the gun in the same manner as for the standing position. Kneel on your right knee with your left foot forward and pointing in the general direction of the target. Lean forward slightly, bracing your left elbow on your left knee and pressing your right elbow against your side to brace against the recoil. Keep your head up so that you can watch the target.

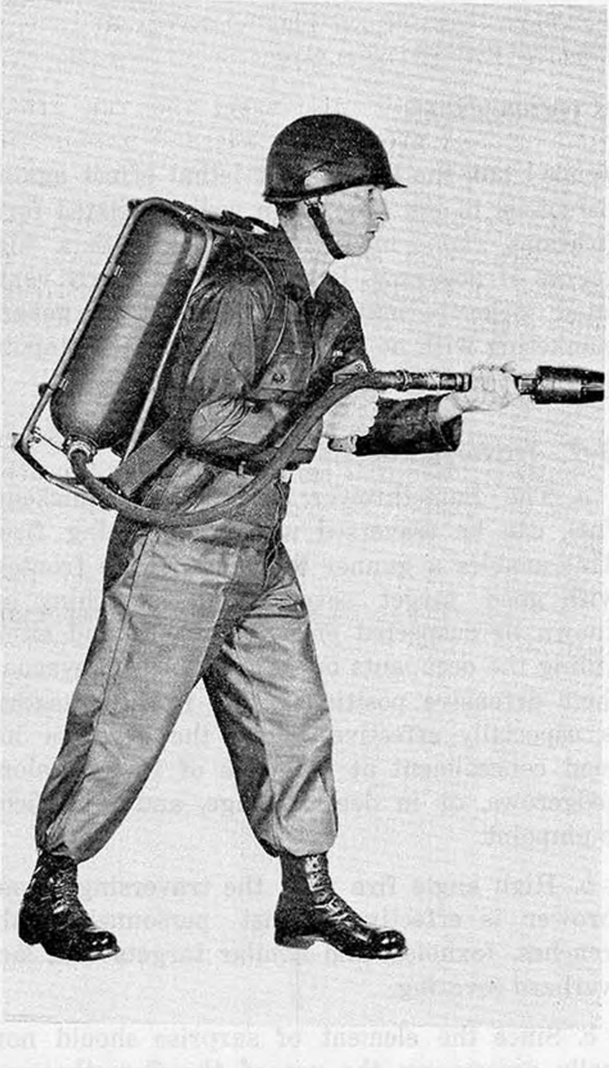


Figure B–1. Firing from the standing position.

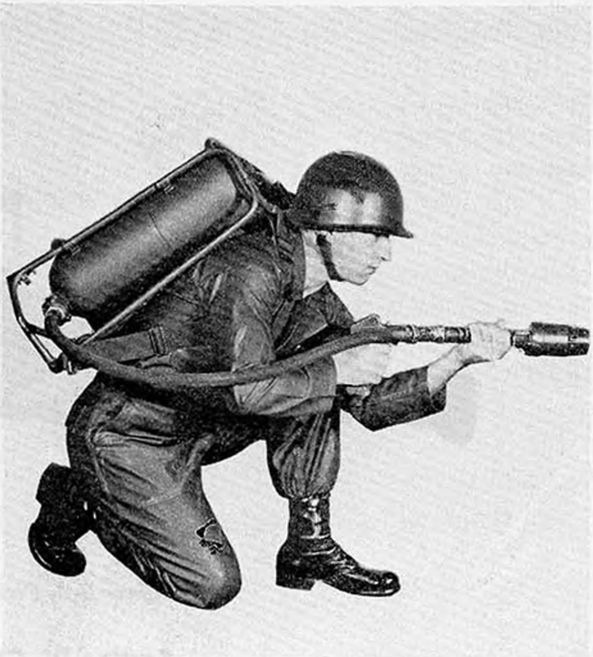


Figure B–2. Firing from the kneeling position.

d. Prone Position. Use the prone position (fig B–3) when you desire to take maximum advantage of a small amount of cover or concealment. To assume the prone position, grip the gun in the same manner as for the standing position. Lie with your head toward the target and your body generally alined with the target. Brace both elbows on the ground to absorb the recoil. Keep your head up so that you can watch the target.

B–4. Aiming

Since there are no sights on the gun, you must aim by estimation. After the first burst reaches the target, quickly adjust the gun so that most of the fuel hits the target. When employing the flamethrower against fortified positions, be sure that the flame enters the opening (gun ports, firing slits, ventilation holes, or doorways). Flame on the outside has little effect on the personnel within. With practice, you should be able to direct the flame into small openings with the initial burst.

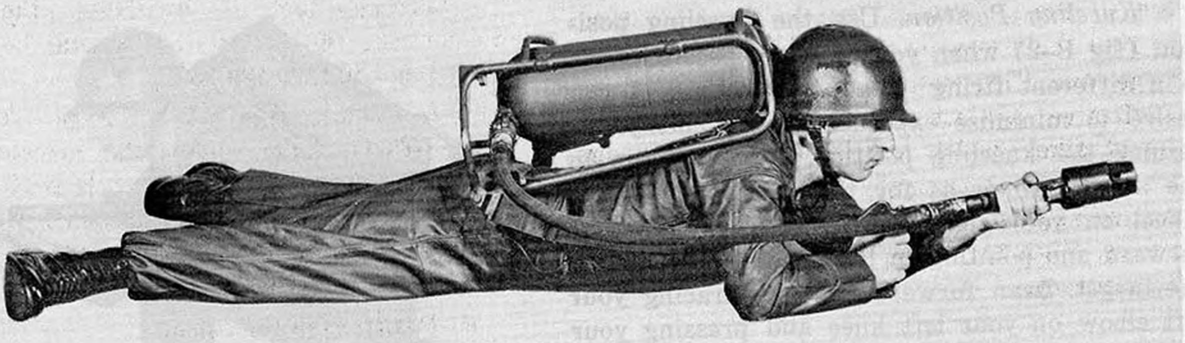


Figure B–3. Firing from the prone position.

Section II. GUNNERY TECHNIQUES

B–5. Fundamentals

The point of attack from which flame will be discharged against the target should be indicated on the ground to the flamethrower gunner. Three fundamental gunnery techniques involved in successful flame efforts, especially against point targets, are as follows:

a. Initially the flame rod should be fired onto the top of the target and immediately depressed into the target. By being over the target with the first burst, the gunner is assured he is within range, and the target is not temporarily obscured for well-sighted and rapid subsequent bursts. A short burst may cause the firer to believe he is on the target because the billow of flame at the point of impact may obscure the target.

b. Once on the target, the gunner should use sufficient flame to accomplish the mission within limitations of the weapon. He may fire one long continuous burst or short bursts, at his discretion.

c. Bursts should be delivered from a stationary position. Movement decreases accuracy and endangers the flamethrower gunner. Fire, vapor, and unburned fuel may blow back toward the gunner when he is advancing rapidly and firing with unthickened fuel.

B–6. Accuracy

Flame can be fired with accuracy through small apertures. The degree of accuracy required depends upon the target. For lethal effect against personnel in the open or in well-ventilated fortifications, flame must be directed with a high degree of accuracy. Personnel in a poorly ventilated inclosure may be subjected to a general blanketing with no particular regard for pinpoint accuracy, and casualties may be expected.

B–7. Traversed Bursts

a. The flamethrower, when using thickened fuel, can be traversed while it is being fired. This enables a gunner to cover a wide frontage with good target coverage by searching out known or suspected enemy positions and either killing the occupants or forcing them to evacuate their defensive positions. This flushing method is especially effective where the defender has good concealment at the edge of forests, along hedgerows, or in dense foliage, and is difficult to pinpoint.

b. High angle fire with the traversing flamethrower is effective against personnel in slit trenches, foxholes, and similar targets that lack overhead covering.

c. Since the element of surprise should normally accompany the use of the flamethrower, this weapon should not be used against individuals who can be destroyed by other weapons; this use wastes fuel and unnecessarily reveals the position of the flame gunner.

B-8. High Trajectory Bursts

Good searching and demoralizing action is obtained by employing a high trajectory traversed shot. Thickened fuel fired in this manner breaks apart in the air and falls in small, fiery blobs that find their way into defiladed positions over a large area. This method of attack is particularly effective against reverse slopes, defiladed sides of dikes, walls, low buildings, and hedgerows that cannot be easily penetrated. It is also effective against personnel in slit trenches and foxholes. High trajectory bursts can be delivered with accuracy.

B-9. Blind Angle Bursts

a. Blind angle bursts may be fired with both thickened and unthickened fuel from positions protected from returned enemy fire.

(1) The characteristic behavior of unthickened fuel is billowing action and a rapidly expanding fireball accompanied by heat and large quantities of dense black smoke. This behavior lends itself readily to bursts fired parallel to windows, gunports, and similar type openings. The expanding and billowing action of the burst forces hot gases, smoke, and flame into these openings so that the defenders cannot fire directly at the flamethrower gunner. Unthickened fuel may be effectively directed at short range immediately in front of or to one side of openings if the flamethrower is fired slightly below the top of the portal. When the fireball is delivered in this manner, most of it has a tendency to be sucked into the target's interior.

(2) Blind angle bursts with thickened fuel use the ability of this type of fuel to penetrate openings and ricochet in fiery blobs within interiors.

b. Considerable protection for flame gunners can be provided if they fire from positions at minimum angles to defensive portals.

B-10. Targets

a. Attacking Troops. Against attacking troops, flame should be directed so that it will strike personnel. Flame employed in the open has little, if any, effect on personnel once the flame is on the ground. However, the intense heat and smoke will blind the attacker temporarily and prevent him from delivering aimed fire, thus serving to discourage his attack.

b. Stationary Objects. Against stationary objects such as supply dumps, storage facilities, and other large installations, flame should be directed on the upwind side of the installation. If adequate fuel is available, the materiel throughout the installation should be saturated with fuel and then ignited.

c. Buildings. Against buildings (fortified or unfortified), flame should be directed toward the interior or at any flammable part of the exterior. It may be necessary to penetrate the walls of the building with other weapons to permit passage of the flame.

d. Positions in the Open.

(1) *Natural cover.* When directing flame at positions of natural cover, two methods may be employed. First, flame may be directed at the near edge or opening of the cover so that it will splash into the position. Second, the flame may be projected at a high angle so that burning blobs will shower down behind the cover.

(2) *Trenches and foxholes.* The most effective method of employing flame against trenches and foxholes is to cover the entire area with low bouncing shots. These cause the flame to splash and increase in effectiveness. Flame may also be directed into the area by elevating the flame gun and allowing the flame to rain down into the emplacements.

e. Fortifications.

(1) *Buildings.* In the attack of a fortified building, every effort is made to project the flame into the building; other weapons may be used to provide an opening for flame passage. However, this is not always possible, and sufficient flame should be provided to smother the fortified building.

(2) *Pillboxes.* It will seldom be possible to project the flame into the interior of a pillbox. Therefore, sufficient flame should be provided to asphyxiate the defenders.

(3) *Caves.* Caves should be fired on with a flame shot to clear the entrance and then with a frontal burst to reach into the back. The entrance may then be sealed with high explosives.

f. Buildings in Towns and Cities.

(1) *Basements.* In fighting in towns and cities, the infantry normally points out flame targets. Openings should be made to permit the flame to be projected into the basements or other parts of the buildings.

(2) *Upper floors.* Directing flame at the upper floors of buildings should be undertaken with caution, as winds have a tendency to change direction quickly in built-up areas or cities and may blow the flame back on the operator.

Section III. FAMILIARIZATION AND QUALIFICATION COURSES

B–11. Familiarization Training

a. Preliminary Training. Soldiers who are to fire the familiarization course with the portable flamethrower should receive a minimum of 3 hours preliminary training before they are allowed to fire. This training should include mechanical training, fuel preparation, positions, aiming, and safety precautions. Sample lesson outlines for this type of training are shown in Army Subject Schedule 3–10. To conserve fuel and to make certain that soldiers understand gunnery techniques and safety precautions before they actually fire burning fuel, water may be fired in the early stages of training. Water should supplement rather than replace the use of fuel because it does not give the exact effect of recoil and its trajectory differs from that of fuel.

b. Familiarization Firing. Soldiers should fire at least one flamethrower filled with unthickened fuel and one with thickened fuel. The table in *c* below shows a familiarization course that may be used. This course gives the soldier experience in firing both types of fuel from three different positions.

c. Firing in the Open—Aperture Target.

Range in meters	Position	Fuel
15–20	Kneeling	Unthickened
15–20	Standing	Unthickened
35–40	Kneeling	Thickened
35–40	Prone	Thickened

Note. Only one burst of flame will be fired at each target; flame must penetrate the aperture to be effective.

B–12. Qualification Course

a. From 14 to 20 hours are required to train and qualify a flamethrower gunner. The qualification course described in paragraphs B–17 through B–19 shows the amount and general nature of the training needed to prepare men and units to use flamethrowers in combat.

b. The commanders of all units should use portable and mechanized flamethrowers to the maximum extent in appropriate tactical problems.

B–13. Purpose of Qualification Course

The purpose of the qualification course is to—

a. Standardize training.

b. Provide official recognition for ability and diligence in training.

c. Increase the confidence of troop commanders in gunners untried in combat.

d. Increase the gunner's confidence in himself.

B–14. Classification of Gunners

Portable flamethrower gunners are divided into three classes, based on the following qualification scores:

126–135	Expert
116–125	First class
100–115	Second class

B–15. Examination

The examination is divided into the following four parts (these parts are further divided into a number of tests that are outlined in paragraph B–17):

Nomenclature and functioning	20 points
Mixing the fuel and charging the flamethrower	15 points
Marksmanship	80 points
Care and cleaning	20 points
Total credit	135 points

B–16. General Rules Governing Examining Board

a. A board of four or more officers or noncommissioned officers examines and scores each candidate on the qualification course requirements. Each board member should be a qualified flamethrower gunner.

b. The conditions of the examination are, as nearly as possible, the same for all men. Each candidate is examined singly and required to answer all test questions and perform all test requirements.

c. Each man is allowed to arrange his equipment as he desires, provided he does not violate the conditions of any particular test. The equipment is arranged on a stand or table in full view of the examining board.

d. When a candidate unnecessarily removes or disassembles a part of the flamethrower in performing any part of the examination, he receives no credit for that particular part of the test.

e. The examining board may deduct no more than the stated value for any part of the test.

f. Each candidate fires the firing table (para B–19*k*) at least once before taking the marksmanship phase of the qualification course.

g. Notes for examining board are as follows:

(1) A starting point should be provided for each target at least 30 meters from the maximum range allowed for engaging the target.

(2) Each target should be approximately 1-meter wide, 1-meter thick, and 1/2-meter high, and plainly visible to the gunner at the required range to engage the target.

(3) Each target must have an aperture approximately 30 by 75 centimeters on each of its four sides. The apertures must be in line with each other or connected within the target so that flame penetration may be observed.

(4) The eight targets should be spotted over an area in a zigzag pattern. The distance between the starting positions and targets Nos. 1 through 4 should vary between 50 and 75 meters. The distance between the starting positions and targets Nos. 5 through 8 should vary between 75 and 100 meters.

(5) The technical information regarding the operation and functioning of the portable flamethrower may be obtained from TM 3–1040–204–14.

B–17. Subjects and Ratings

a. Nomenclature and Functioning.

(1) Nomenclature and functioning of the pressure system	6 points
(2) Nomenclature and functioning of the fuel system	6 points
(3) Nomenclature and functioning of the gun group	6 points
(4) Removal and replacement of the ignition cylinder	2 points
	20 points

b. Mixing the Fuel and Charging the Flamethrower.

(1) Mixing the fuel	5 points
(2) Evaluating the fuel	2 points
(3) Filling and charging the flamethrower	8 points
	15 points

c. Marksmanship.

(1) Firing in open area:

(*a*) Kneeling	10 points
(*b*) Standing	6 points
(*c*) Standing	6 points
(*d*) Kneeling	10 points
	32 points

(2) Firing in heavily wooded area:

(*a*) Kneeling	14 points
(*c*) Standing	10 points
(*a*) Standing	10 points
(*d*) Kneeling	14 points
	48 points

d. Care and Cleaning.

Cleaning the flamethrower after firing	20 points
Total credit	135 points

B–18. Examination Equipment

The following equipment is available to each candidate for the examination:

a. M2A1–7 portable flamethrower (empty).

b. Cleaning material.

c. Grease, lubricating, automotive and industrial, type A, grade 2.

d. Oil, lubricating, preservative, special.

e. Gasoline.

f. Fuel thickener, M1 or M4.

g. Mixing buckets or empty fuel drums.

h. Wooden paddle for mixing fuel.

i. Liquid measures of gallon and quart capacity.

j. Scales for weighing thickener.

k. Funnel.

l. Ignition cylinder.

m. Nitrogen or compressed air cylinders coupled in manifold, with at least one cylinder charged with 1,700 to 2,100 pounds of pressure per square inch of AN–M4 compressor and M27 service kit.

n. Tool roll for portable flamethrower.

B–19. Details of Performance

a. Test on the Nomenclature and Functioning of the Pressure System.

(1) *Situation.* Provide each man with a tank group.

(2) *Requirement.* Give the nomenclature and describe the functioning of the pressure system; trace the flow of pressure from the pressure tank to the fuel tanks in the correct sequence.

(3) *Scoring.* Give six points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in the proper sequence.

(*a*) Pressure tank.
(*b*) Pressure tank valve.
(*c*) Regulator tube.
(*d*) Pressure regulator.
(*e*) Safety head assembly.
(*f*) Diffusion tube.
(*g*) Fuel tanks.

b. Test on the Nomenclature and Functioning of the Fuel System.

(1) *Situation.* Provide each man with a complete flamethrower.

(2) *Requirement.* Give the nomenclature and trace the flow of fuel from the fuel tanks to the ignition section in the correct sequence.

(3) *Scoring.* Give six points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in sequence.

(*a*) Fuel tanks.
(*b*) Tank connector.
(*c*) Quick release coupling.
(*d*) Fuel hose.
(*e*) Barrel and valve assembly.
(*f*) Ignition section.

c. Test on the Nomenclature and Functioning of the Gun Group.

(1) *Situation.* Provide each man with a complete gun group.

(2) *Requirement.* Give the nomenclature and describe the functioning of the four assemblies of the gun group.

(3) *Scoring.* Give six points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in sequence.

(*a*) Fuel hose.

(*b*) Valve section (consists of the valve lever, valve safety lever, inlet body, barrel, and nozzle).

(*c*) Ignition section (consists of the ignition lever, ignition safety lever, nozzle shield, and ignition pin).

d. Test on the Removal and Replacement of the Ignition Cylinder.

(1) *Situation.* Provide each man with a complete gun group with an ignition cylinder installed.

(2) *Requirements.* Remove and replace the ignition cylinder.

(3) *Scoring.* Give two points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in sequence.

(*a*) Depress the nozzle shield latch.
(*b*) Remove the nozzle shield.
(*c*) Remove the ignition cylinder.
(*d*) Replace the ignition cylinder.
(*e*) Properly seat the ignition cylinder.
(*f*) Replace the nozzle shield.

e. Test on Mixing Thickened Fuel.

(1) *Situation.* Provide each man with the necessary equipment for mixing thickened fuel (para B–18 above).

(2) *Requirement.* Mix 1 gallon of thickened fuel so that the the thickener is 2.1 percent by weight if M4 thickener is used or 4.2 percent by weight if M1 thickener is used.

(3) *Scoring.* Give five points for correctly completing the requirement. Give no credit if all requirements in the following checklist are not observed:

(*a*) Use clean containers to mix fuel.

(*b*) Mix the fuel and thickener in correct proportion.

(*c*) See that the thickener does not settle to bottom.

(*d*) See that the thickener is not in lumps in the mixture.

(*e*) See that the fuel does not begin to gel before all thickener has been added.

(*f*) Do not use galvanized metal containers.

f. Test on the Evaluation of Fuel.

(1) *Situation.* Provide each man with several batches of thickened fuel.

(2) *Requirement.* Select the batch of thickened fuel best suited for firing from the portable flamethrower, based on information contained in TM 3–366.

(3) *Scoring.* Give two points for correctly completing the requirement. Give no credit if the best fuel is not selected.

g. Test on Filling Fuel Tanks and Charging Pressure Tanks.

(1) *Situation.* Provide each man with the

necessary equipment for filling and charging the flamethrower.

(2) *Requirement.* Properly fill the fuel tanks and charge the pressure tank.

(3) *Scoring.* Give eight points for correctly completing the requirement. Give no credit if any part of the following checklist is missed, if any threads are damaged, or if necessary adjustments are not made to stop leaks during the procedure.

(*a*) Remove filler plugs.

(*b*) Pour the fuel into the fuel tanks (4 1/2 to 4 3/4 gallons).

(*c*) Replace the filler plugs.

(*d*) Test for correct type of gas in commercial cylinders or perform required preventive maintenance on compressor.

(*e*) Close the pressure tank valve.

(*f*) Connect the charging line fitting to the check valve.

(*g*) Close the bleeder valve on the charging line.

(*h*) Close the filler line valves.

(*i*) Open the commercial cylinder valves or start compressor.

(*j*) Fill the pressure tank to the correct pressure (1,700 to 2,100 pounds per square inch), starting with the lowest pressure in the commercial cylinders, then the next highest, and so on until the charging is completed, opening and closing each filler line valve in turn.

(*k*) Bleed the charging line.

(*l*) Disconnect the charging line.

(*m*) Replace the check valve cap.

h. Marksmanship Test—Firing in the Open.

(1) *Situation.* Provide each candidate a fully filled (thickened fuel) and charged flamethrower with an ignition cylinder for engaging targets Nos. 1 through 4, as shown on the firing table (*k* below). Clearly define the starting station for each target and be sure the target will be visible from the station. Use a different starting station for each target. Do not disclose the range from the starting point to the target. Targets will be in the open so that they are visible to the candidate while he is moving forward. Only one burst of flame will be fired at each target.

(2) *Requirement.* Execute all steps preparatory to firing; move to the firing position for targets No. 1, 2, 3, and 4 and fire on the target (all targets will be engaged from the windward side); and perform the correct after-firing procedures.

(3) *Scoring.*

(*a*) Target No. 1 has a value of 10 points. Give two points for correctly performing the before-firing procedure according to the following checklist. Give no points unless each step is performed correctly and in the stated sequence. Give eight points for penetrating the target with flame. Give no part of this eight-point credit if the flame does not penetrate the target, if the wrong position is used, or if the target is engaged outside the range limits prescribed in the firing table.

1. Adjust the carrier and straps.

2. Install the ignition cylinder correctly.

3. Open the pressure tank valve.

4. Move the firing position.

5. Assume the correct position.

6. Ignite the ignition cylinder.

7. Compress the valve lever.

(*b*) Targets No. 2 and 3 have a value of six points each. Give the six points if the flame penetrates the targets. Give no credit if the flame does not penetrate the target, if the wrong position is used, or if the target is engaged outside the range limits prescribed in the firing table.

(*c*) Target No. 4 has a value of 10 points. Give eight points for penetrating the target with flame. Give no part of this eight-point credit if the flame does not penetrate the target, if the wrong position is used, or if the target is engaged outside the range limits prescribed in the firing table. Give two points for correctly completing the after-firing procedure according to the following checklist. Do not give this two-point credit if each step is not performed correctly and in the stated sequence.

1. Close the pressure tank valve.

2. Remove the ignition cylinder.

3. Blow out the vapor in the fuel tanks.

i. Marksmanship Test—Firing in Heavily Wooded Area.

(1) *Situation.* Provide each candidate a completely filled (thickened fuel) and charged flamethrower and an ignition cylinder for firing at targets No. 5 through 8. Clearly define the starting station for each target. Make sure the target will be visible from each station. Use a different starting station for each target. Do not disclose the range from the starting station to the target. Targets will be in a heavily wooded area with rough terrain so that they are not

always visible to the candidate while he is moving forward. Only one burst of flame is fired at any one target.

(2) *Requirement.* Execute all before-firing procedures; move to firing positions for targets No. 5, 6, 7, and 8, taking advantage of available cover; fire on the targets (all targets will be engaged from the windward side); and execute all after-firing procedures.

(3) *Scoring.*

(*a*) Target No. 5 has a value of 14 points. Give two points for correctly completing the before-firing procedure according to the following checklist. Do not give this two-point credit if each step is not performed correctly and in the stated sequence. Give 12 points for penetrating the target with the flame. Give no part of the 12 points if the flame fails to penetrate the target, if the wrong position is used, or if the target is engaged outside the range limits prescribed in the firing table.

1. Adjust the carrier and straps.

2. Install the ignition cylinder correctly.

3. Open the pressure tank valve.

4. Move to the firing position.

5. Assume the correct firing position.

6. Ignite the ignition cylinder.

7. Compress the valve lever.

(*b*) Targets No. 6 and 7 have a value of 10 points each. Give 10 points for penetrating each target with the flame. Give no credit if the flame does not penetrate the target, if the wrong position is used, or if the target is engaged outside the range limits prescribed in the firing table.

(*c*) Target No. 8 has a value of 14 points. Give 12 points for penetrating the target with the flame. Give no part of the 12 points if the flame does not penetrate the target, if the wrong firing position is used, or if the target is engaged outside the range limits prescribed in the firing table. Give two points for correctly performing the after-firing procedures according to the following checklist. Give no points unless each step is performed correctly and in the stated sequence.

1. Close the pressure tank valve.

2. Remove the ignition cylinder.

3. Blow out the vapor in the fuel tanks.

j. Test on Care and Cleaning.

(1) *Situation.* Provide each man with the necessary equipment for cleaning and lubricating the flamethrower.

(2) *Requirement.* Clean the flamethrower used when firing the marksmanship course. The flamethrower is cleaned as directed in TM 3–1040–204–14.

(3) *Scoring.* Give 20 points for correctly cleaning and lubricating the flamethrower according to the following checklist. Give no credit if the flamethrower does not pass the board's inspection for cleanliness or if any item of the checklist is omitted.

(*a*) Remove the ignition cylinder.

(*b*) Open the pressure tank valve and blow out the remaining fuel before proceeding with the cleaning.

(*c*) Disconnect the hose and gun group from the tank group.

(*d*) Clean the gun group and the hose assembly.

(*e*) Lubricate the gun group.

(*f*) Remove the filler plugs and flush the tank with gasoline.

(*g*) Reassemble the cleaned parts.

k. Firing Table.

Target No.	Position	Fuel	Range limits	Score
1	Kneeling	Thickened	20 to 25 meters	10
2	Standing	Thickened	20 to 25 meters	6
3	Standing	Thickened	30 to 35 meters	6
4	Kneeling	Thickened	30 to 35 meters	10
5	Kneeling	Thickened	35 to 40 meters	14
6	Standing	Thickened	35 to 40 meters	10
7	Standing	Thickened	30 to 35 meters	10
8	Kneeling	Thickened	35 to 40 meters	14
			Total	80

Section IV. SAFETY

B-20. General

Before firing, take all possible precautions to prevent injury to personnel or damage to property. Familiarize all personnel with the operation of the equipment they are to handle and with the safety precautions specified in TM 3-1040-204-14, TM 3-366, and AR 385-63.

B-21. Regulations

The officer in charge will be responsible for enforcing the following rules and regulations:

a. For initial training and indoctrination firing, a practice range free of vegetation and other flammable material must be available. For portable flamethrowers, the minimum range area is 110 meters long by 100 meters wide. For transition or combat training, any range may be used.

b. Portable flamethrowers will not be fired into a headwind greater than 5 miles per hour when filled with unthickened fuel. Flamethrowers will not be fired against abrupt terrain or obstacles (for example, trees or buildings) nearer than 15 meters from spectators and 6 meters from the firer.

c. An emergency vehicle containing proper first-aid equipment for burns and personnel trained in first-aid measures will be available in the immediate vicinity of the firing. All firing is to cease in case the emergency vehicle leaves the vicinity.

d. Extreme care will be taken to provide adequate firefighting facilities. During the initial training, two 10-pound CO_2 fire extinguishers will be manned 10 meters to the rear of the flamethrower during firing.

e. Signs will be posted barring open flames or other sources of ignition, and prohibiting personnel from smoking within 50 meters of any flamethrowers or scene of filling and charging operations.

f. Officer in charge will be thoroughly familiar with the operation of the weapon, filling and charging procedures, and first aid for casualties caused by burns.

g. All firing, filling, and charging operations will be under the direct supervision of thoroughly trained personnel.

h. All applicable provisions or regulations pertaining to the use of fuels and pressure will be followed.

i. Before fuel filling, pressure charging, and firing, the officer in charge will inspect all equipment for serviceability and safety of operation.

j. *Oxygen* and flammable gases will *never* be used to charge pressure tanks or containers.

k. An instructor will be on hand to aid and direct each firer during initial training and indoctrination firing. He will be available during range firing.

l. A wet or fireproof blanket or comforter will be available to supplement fire extinguishers.

Note. To make one standard service blanket flame resistant, you need the following materials: (1) sodium tetraborate (borax), 9 ounces; (2) boric acid, 4 ounces; and (3) warm water, 1 gallon. Stir the chemicals into the warm water. Place the blanket into the solution. Soak, then *hand wring* the blanket and hang up to dry. (For use during firing, leaving the blanket in the solution on the firing line is acceptable.) This procedure also applies to clothing. Reimpregnate whenever the cloth (blanket or uniform) has been washed, drycleaned, or bleached.

m. During firing, personnel other than instructors, coaches, or assistant operators will not be permitted within 10 meters of either side or rear of the flamethrower, or within the danger zone shown in figure B-4.

n. The maximum depression during firing will not exceed 20 degrees.

o. When fuel is expended, remaining pressure in the fuel tanks will be blown down (released) away from any fire or fuel burning on the ground. Ignition will not be used when the flamethrower is blown down.

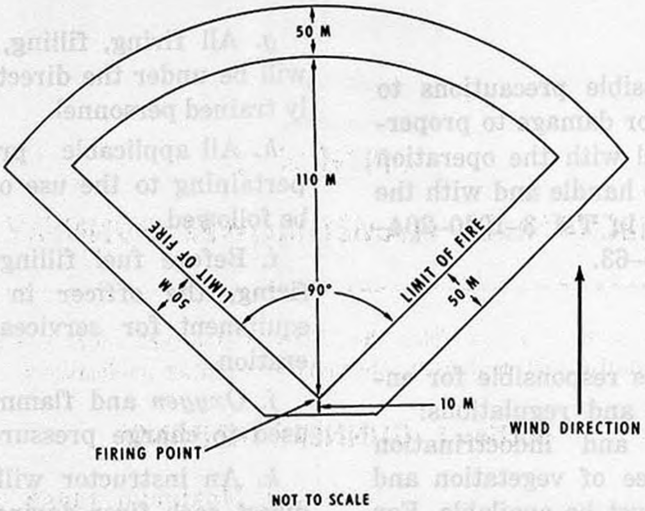

50 M
110 M
LIMIT OF FIRE
50 M
90°
LIMIT OF FIRE
50 M
10 M
WIND DIRECTION
FIRING POINT
NOT TO SCALE

Figure B-4. Surface danger zones when firing the portable flamethrower.

APPENDIX C

MECHANIZED FLAMETHROWER GUNNERY

Note. This tentative training course (adapted from the M67A1 flame tank course) is intended for use, pending publication of familiarization and qualification courses in appropriate training publications.

Section I. GUNNERY TRAINING

C–1. General

a. The mechanized flamethrower gunner is required to know three things about his operation: how to operate and fire the flame gun and 7.62-mm machinegun, and how to drive the vehicle. He must understand and have a through knowledge of the firing procedures, characteristics of flame and flame weapons, and flame techniques. He should initially be trained and qualified with the portable flamethrower (app B) before undergoing training with the mechanized types.

b. Instructions on safety for the mechanized flamethrowers are contained in AR 385–63. Ranges and suggested targets are contained in paragraph C–3. Schedules and lesson outlines for training mechanized flamethrower gunners are described in Army Subject Schedule 3–3.

C–2. Gunnery Techniques

a. Being liquid or semiliquid, flame fuel does not form a solid, rigid projectile such as that from an artillery shell. The fuel rod is deformed by the air through which it passes. The amount of deformation depends not only on the velocity of the fuel but also on its viscosity and cohesiveness. The more cohesive the fuel, the harder it is to deform and the better its flight characteristics. Maximum range for an unignited shot is obtained when there is a minimum deformation; that is, when the fuel is ejected as a smooth rod and retains that shape until it reaches the target. An ignited fuel rod achieves almost two-thirds the range of an unignited one when other conditions are similar.

b. Effective range is the distance from the flame projector nozzle to the center of the main bulk of fuel on the ground, when the flamethrower is fired at optimum elevation.

c. Maximum range is the distance from the flame projector nozzle to the farthest point of fuel deposit on the ground, when the flamethrower is fired at optimum elevation. The maximum effective range is not always obtained at higher elevations. This is due to the effect of air resistance on the fuel jet, which will eventually break it up and result in a raining effect on the target.

C–3. Introduction to Firing

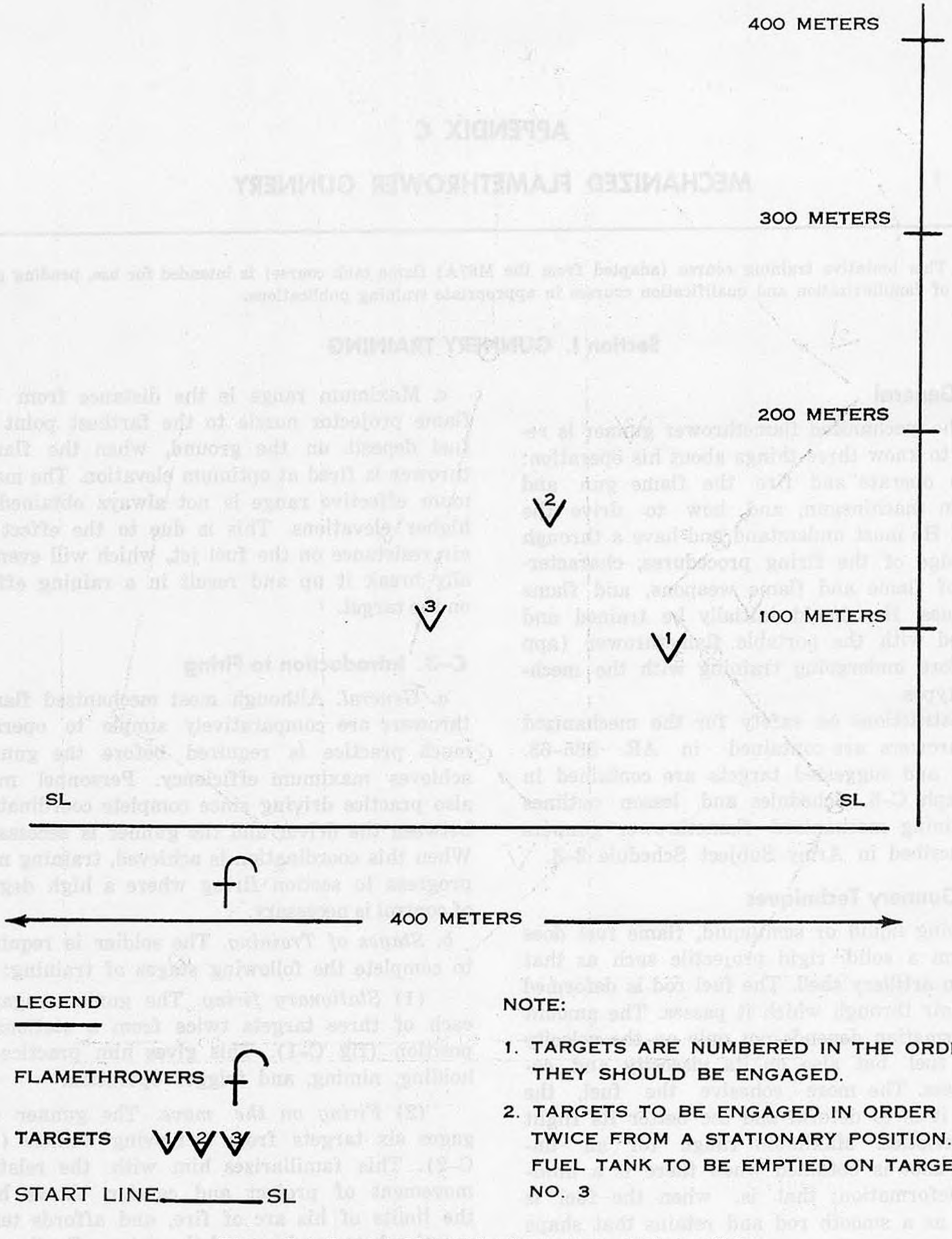
a. General. Although most mechanized flamethrowers are comparatively simple to operate, much practice is required before the gunner achieves maximum efficiency. Personnel must also practice driving since complete coordination between the driver and the gunner is necessary. When this coordination is achieved, training may progress to section firing where a high degree of control is necessary.

b. Stages of Training. The soldier is required to complete the following stages of training:

(1) *Stationary firing.* The gunner engages each of three targets twice from a stationary position (fig C–1). This gives him practice in holding, aiming, and trigger operation.

(2) *Firing on the move.* The gunner engages six targets from a moving vehicle (fig C–2). This familiarizes him with the relative movement of project and carrier, shows him the limits of his arc of fire, and affords team practice between him and the driver. Further, it teaches him to accept full command of the vehicle and responsibility for controlling its direction by signals to the driver.

(3) *Section firing.* The soldiers participate as gunners of a section in a simple flame attack (fig C–3).


400 METERS
300 METERS
200 METERS
100 METERS
2
3
1
SL
SL
400 METERS
LEGEND
FLAMETHROWERS
TARGETS
1 2 3
START LINE
SL

NOTE:

1. TARGETS ARE NUMBERED IN THE ORDER THEY SHOULD BE ENGAGED.
2. TARGETS TO BE ENGAGED IN ORDER TWICE FROM A STATIONARY POSITION. FUEL TANK TO BE EMPTIED ON TARGET NO. 3

Figure C–1. Suggested layout for flame range, stationary firing.

Note. Stages outlined in (2) and (3) above are repeated, with each gunner performing the duties of the driver.

C–4. Sequence of the Simple Flame Attack

a. Normal carrier tactics from the fueling point to the start line are employed; that is, reconnaissance, support, and maneuver, using mutual support where necessary.

(1) The flame section normally follows the infantry to the start line.

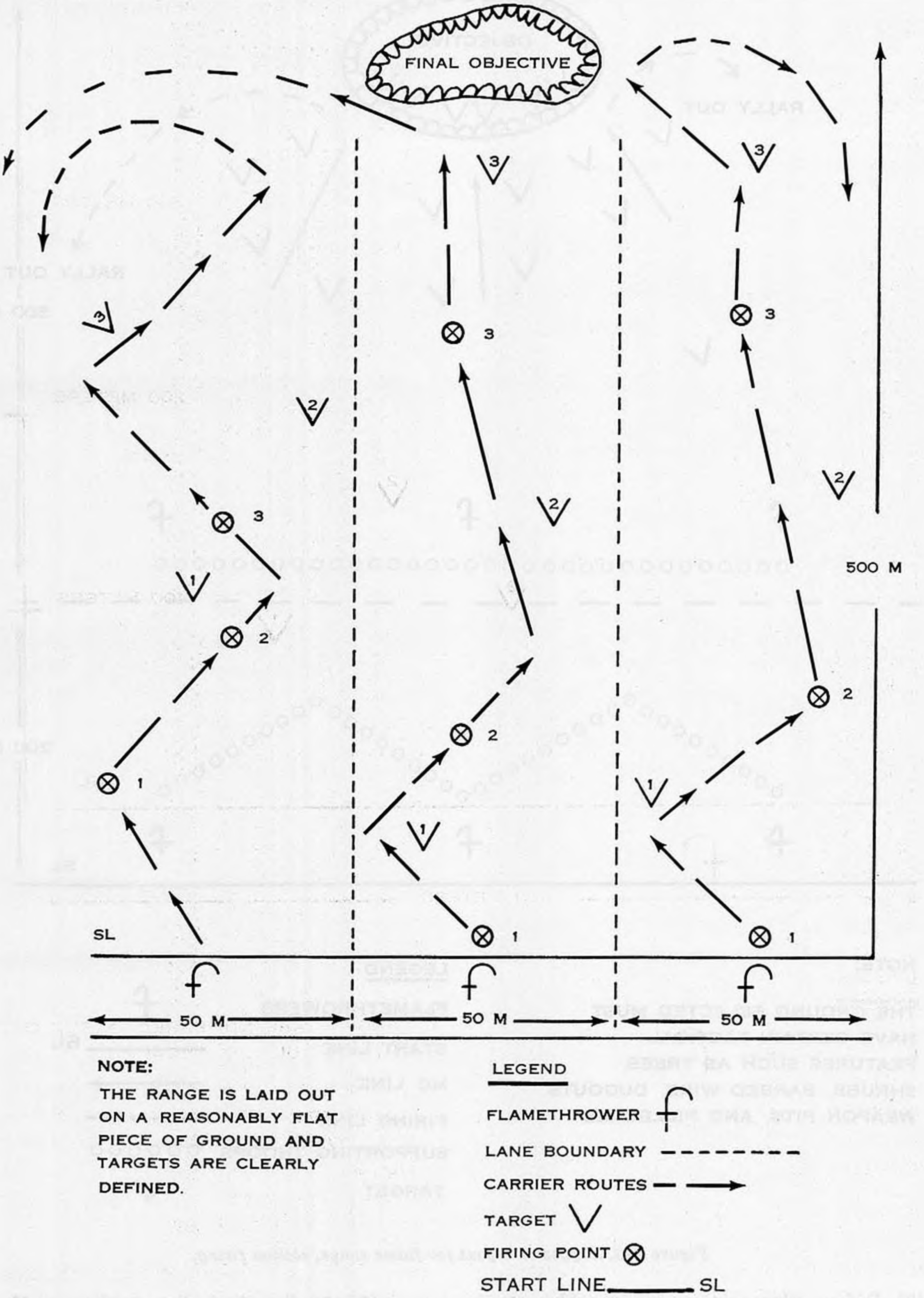

FINAL OBJECTIVE
3
3
3
2
2
2
1
1
1
SL
50 M
50 M
50 M
500 M
NOTE:
THE RANGE IS LAID OUT ON A REASONABLY FLAT PIECE OF GROUND AND TARGETS ARE CLEARLY DEFINED.
LEGEND
FLAMETHROWER
LANE BOUNDARY
CARRIER ROUTES
TARGET
FIRING POINT
START LINE SL

Figure C–2. Suggested layout for flame range, firing on the move.

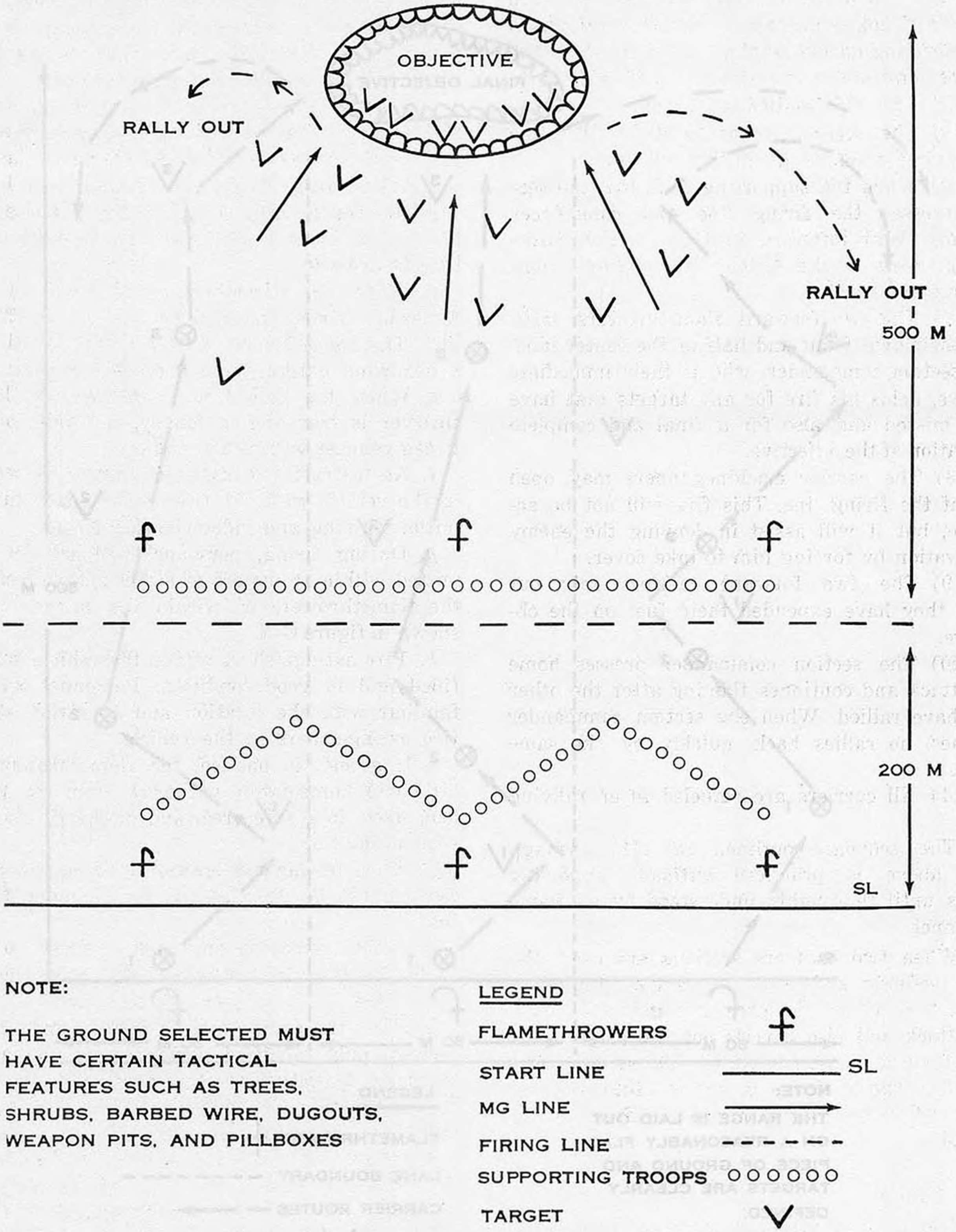

OBJECTIVE
RALLY OUT
RALLY OUT
500 M
200 M
SL
NOTE:
THE GROUND SELECTED MUST HAVE CERTAIN TACTICAL FEATURES SUCH AS TREES, SHRUBS, BARBED WIRE, DUGOUTS, WEAPON PITS, AND PILLBOXES
LEGEND
FLAMETHROWERS
START LINE
SL
MG LINE
FIRING LINE
SUPPORTING TROOPS
TARGET

Figure C–3. Suggested layout for flame range, section firing.

(2) Before the section crosses the start line, the equipment should be under pressure, tested for ignition, and given a final check.

(3) At the start line, either a V or extended line formation is adopted, with the section commander in the center.

(4) A distance between the two forward carriers of approximately 75 meters is maintained, depending on the frontage to be covered. The section commander is about 25 to 35 meters to the rear if the V formation is adopted.

(5) The section moves to the firing line (immediately behind assaulting troops).

(6) When the supporting fires lift, the section crosses the firing line and commences flaming. (With infantry, the flame section moves through them to the firing line before commencing to flame.)

(7) The two forward flamethrowers saturate their own front and half of the center lane. The section commander, who is their immediate reserve, holds his fire for any targets that have been missed and also for a final and complete saturation of the objective.

(8) The carrier machinegunners may open fire at the firing line. This fire will not be accurate, but it will assist in denying the enemy observation by forcing him to take cover.

(9) The two forward carriers rally out after they have expended their fuel on the objective.

(10) The section commander presses home his attack and continues flaming after the other two have rallied. When ehe section commander finishes, he rallies back quickly by the same route.

(11) All carriers are refueled after rallying out.

b. The sequence outlined in *a*(1) through (11) above is practiced without supporting troops until thoroughly understood by all flame personnel.

c. When two or more sections are used, the same methods are employed, except that in a two-section attack the platoon commander leads the attack and also carries out the original reconnaissance, accompanied by his section commanders. The objective is divided into sections, with section boundaries and objectives clearly defined.

C-5. Safety

In addition to applicable portions of section IV, appendix B, and safety precautions specified in TM 3-1040-209-12 and AR 385-63, the following safety requirements will be observed:

a. For initial training and indoctrination firing (stationary firing), a practice range free of vegetation and other flammables must be available. For mechanized flamethrowers, the minimum range area is 275 meters long by 110 meters wide. Normally, flamethrowers are fired singly with a minimum of nine targets.

b. For individual firing while moving, flamethrowers are deployed at least 40 meters apart and separated by well-defined boundary lanes.

c. Where targets are not well defined, limiting bars for traverse and elevation are used. In no case will the gun nozzle be depressed more than 20 degrees.

d. When the flamethrower is fired in unfavorable winds, the carrier will be "buttoned up." The flamethrower should not be fired into a headwind greater than 5 miles per hour.

e. When the fueled and pressurized flamethrower is traveling in ionvoy, the interval between vehicles will be 250 meters.

f. An instructor or assistant instructor will be in the vehicle with the firer at all times during initial training and indoctrination firing.

g. During firing, personnel will not be permitted within 10 meters of either side or rear of the flamethrower, or within the danger zone shown in figure C-4.

h. Fire extinguishers within the vehicle will be filled and in good condition. Personnel will be familiar with the location and operation of all fire extinguishers in the vehicle.

i. If a leak is noticed, the flamethrower vehicle will immediately withdraw from the problem, move to a safe area, and discharge its fuel without ignition.

j. When testing the ignition system, the same caution will be exercised as for firing a flame shot.

k. Before removing any caps or plugs to fuel or check the system, personnel will make certain that there is no pressure in the system.

l. When the equipment is fueled and pressurized, only qualified personnel are permitted to make inspection or minor adjustments, and then only when the equipment is in a safe area with the gun nozzle down range.

m. If anyone is accidentally hit by flame, the fire should be extinguished by smothering (for example, rolling on the ground or using a wet blank). *Do not try to slap it out* because this will cause the fire to spread.

n. When fuel is expended, the flamethrower will be moved or aimed away from the last target and the pressure remaining in the fuel tanks will be blown down. Ignition will not be used when the flamethrower is blown down.

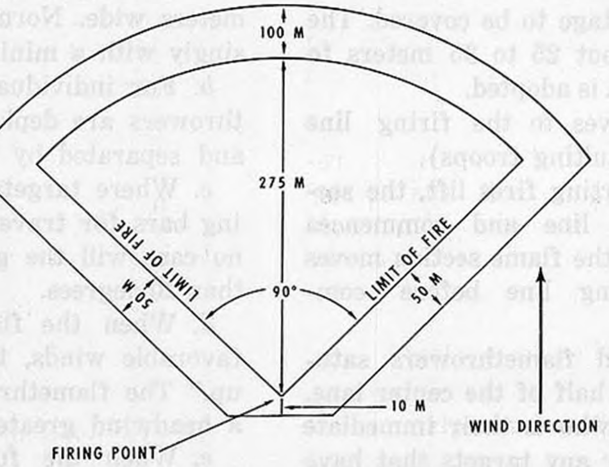


Figure C-4. Surface danger zones when firing the mechanized flamethrower.

Section II. FAMILIARIZATION TRAINING AND QUALIFICATION FIRING

C-6. General

The availability of flamethrowers and suitable terrain will govern the best possible means of testing mechanized flamethrower crews. The crew of the M132-type self-propelled flamethrower consists of two persons, the vehicle commander (gunner) and the driver. These two crewmen must be cross trained. Crewmen being tested are expected to be capable of performing in a flame carrier the primary functions of a flame gunner, driver, and machinegunner. The tests discussed in paragraphs C-7 through C-10 are designed to provide familiarization training on the servicing and firing of the M132-type flamethrower. A suitable flame firing range is required for conducting these tests.

C-7. Test No. 1 (Fueling)

a. Equipment Required. One mechanized flamethrower, a suitable flamethrower service unit, sufficient fuel to refuel the flamethrower, and sufficient gasoline to refuel the ignition tank.

b. Requirements.

(1) The flame gunner is required to fill the ignition gasoline tank.

(2) The flame gunner assisted by the driver is required to refuel the flamethrower.

C-8. Test No. 2 (Pressurizing)

a. Equipment Required. One flamethrower refueled as in Test No. 1 and appropriate compressed air equipment.

b. Requirement. The flame gunner assisted by the driver is required to follow the correct sequence in charging the air tanks to the proper pressure.

Note. The personnel tested should refuel and pressurize the flamethrower and be ready to test the ignition in approximately 40 minutes.

C-9. Test No. 3 (Testing for Ignition)

a. Equipment Required. One flamethrower fueled and pressurized as in Tests No. 1 and 2.

b. Requirement. The flame gunner is required to—

(1) Test the spark.

(2) Test the ignition fuel.

(3) Test the spark and ignition fuel combined.

(4) Explain the procedures and operational value of the tests in (1), and (3) above.

C-10. Test No. 4 (Firing)

a. Equipment Required. One flamethrower fueled, pressurized, and tested for ignition as in Tests No. 1, 2, and 3.

b. Requirements.

(1) *Stationary firing.* The gunner is re-

quired to fire two shots each at three targets, each target at a different range and angle. A minimum of four hits is required. Each of the three targets will be hit at least once within the total of six shots.

(2) *Firing on the move.* The gunner is required to fire at six targets, with the carrier moving at a speed conforming with ground conditions (in any case, a minimum of 10 miles per hour). One hit per target is required.

Note. Fuel tanks are emptied on the last target.

C–11. Firing Proficiency Requirements

a. Stationary Firing. Each gunner is required to fire two shots at each of three targets, each target being at a different range and angle. A minimum of four hits is required, and each target must be hit at least once in the total of six shots.

b. Firing on the Move Individually. Each gunner is required to fire at six targets, with the carrier moving at a speed conforming with terrain conditions (in any case, a minimum of 10 miles per hour). One hit per target is required.

c. Firing on the Move as a Section. Each gunner is required to fire two shots at each of three targets as directed by the section leader. One hit per target is required. Fuel tanks are emptied on the final target engaged.

C–12. Qualification Firing

a. Mechanized flamethrower gunners are divided into three classes, based on the following qualification scores:

84–110 ___________Expert
73– 83 ___________First class
60– 72 ___________Second class

b. Scoring is outlined as follows:

(1) Stationary firing:
Possible score __________ 18 points
(Two hits each target—
6 hits x 3)
(2) Firing on the move individually:
Possible score __________ 30 points
(One hit per target—
6 hits x 5)
(3) Firing on the move as a section:
Possible score __________ 62 points
Each direct hit
per target ______ 10
(Two hits each
target—6 hits x 10)
Each rolling hit
per target ______ 7
(Two hits each target—6 hits x 7)
Credit for fuel exhausted
on final target ____ 2

Total credit ____ 110 points

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By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *13 December 1971*

COMBAT FLAME OPERATIONS

FM 20–33, 16 July 1970, is changed as follows:

1. Remove old pages and insert new pages as indicated below.

Remove pages—	*Insert pages—*
1	i
1–1 and 1–2	1–1 and 1–2
2–1 and 2–2	2–1 and 2–2
2–5 and 2–6	2–5 and 2–6
3–1 through 3–3	3–1
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A–1 and A–2	A–1 and A–2
B–1 and B–2	B–1 and B–2
B–7 and B–8	B–7 and B–8
Index–1 through Index–3	Index–1 and 2

2. A star indicates new or changed material.

3. File this sheet in the front of the manual for reference purposes.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:
VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

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COMBAT FLAME OPERATIONS

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*This manual supersedes FM 20-33, 2 June 1967, including all changes.

CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

a. This manual provides doctrinal guidance in combat flame operations. It includes information pertaining to principles of employment of flame, ground flame operations, air flame operations, flame fuels, flame field expedients, flame equipment, and defense against flame.

b. The content of this manual is applicable to nuclear and nonnuclear warfare, internal defense and internal development operations, and operations by Special Forces.

c. The term "infantry," as used throughout the manual, applies to all types of infantry battalions—infantry, airborne infantry, mechanized infantry, airmobile infantry, and light infantry. The term "artillery," as used in the manual, refers to field artillery unless otherwise stated.

1-2. Recommended Changes and Comments

Users of this manual are encouraged to submit recommended changes and comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commanding Officer, U.S. Army Combat Developments Command Chemical-Biological-Radiological Agency, Fort McClellan, Alabama 36201.

1-3. Effects of Flame

★Flame is a valuable close combat weapon that produces burns, oxygen depletion, and psychological impact. Since man fears flame, it is used to demoralize troops and reduce positions that have resisted other forms of attack. Flame produces the following effects:

a. Casualty. Casualties result from: (1) burns—thickened fuel sticks to the clothing and skin, burns with intense heat, and the burning fuel is extremely difficult to extinguish; (2) inhalation of flame, hot gases, and carbon monoxide; (3) suffocation; and (4) shock.

b. Psychological. The psychological impact is probably one of the greatest effects of flame. In many cases, defending personnel will leave well-prepared positions and risk exposure to other weapons or capture. In other cases, the enemy is forced to withdraw from firing positions during the effective period of the flame attack. This withdrawal permits friendly forces to close in before the enemy reoccupies his firing positions.

c. Splatter. Flame can be used to reach around corners through the splattering and ricochet action of the thickened fuel on adjacent surfaces. The splattering action of the thickened fuel spreads the flame over an area in contrast to the point effects of nonfragmenting small arms ammunition.

d. Incendiary. Flame will ignite combustible materials to cause additional problems for defending personnel. Flame weapons can be used to ignite clothing, tentage, wires, petroleum products, buildings of light construction, light vegetation, munitions, and other combustible material.

★*e. Battlefield Illumination and Signaling.* Controlled, slower burning flame field expedients can be used for close-in battlefield illumination and signaling. These devices can be made to vary in illumination time from a few minutes to hours.

★*f. Smoke.* The burning fuel from flamethrowers and flame field expedients produces a dense black smoke that can reduce battlefield visibility appreciably. Smoke from ignited material can prolong this condition. This black smoke may attract the enemy's attention to the flame attack and invite counterfire. To minimize any hindrance to friendly operations, the presence of this smoke must be anticipated when planning operations in which flamethrowers or flame field expedients will be used.

1-4. Flame Weapons

a. General. The flame weapons available are the XM202 rocket launcher and the mechanized and portable flamethrowers.

★*XM202 Rocket Launcher.* This weapon fires a rocket warhead containing pyrophoric fuel—a fuel that ignites spontaneously on exposure to air. Since exposure occurs on impact, this weapon does not waste fuel by burning it en route to the target. This weapon has a greater range than either portable or mechanized flamethrowers, and can be used in most areas in which flamethrowers are used. Ammunition (XM74 rocket clip) is available as a class V item of supply. This weapon is a limited production item.

c. Mechanized and Portable Flamethrowers. These flamethrowers deliver burning fuel on the target. Two types of fuel are available for these weapons: thickened and unthickened. A thickening agent is currently available as a class V item of supply. Thickened fuel gives greater range and accuracy because it is projected as a rod (fig 1-1). The thickened fuel sticks to the target and burns with intense heat. Unthickened fuel burns more rapidly in the air to produce a billowing effect (fig 1-2). When unthickened fuel is used in the portable flamethrower, its range is about one-half that of thickened fuel. Thickened fuel is normally used in the mechanized flamethrower. Since it will penetrate small openings, thickened fuel is more effective than unthickened fuel against inclosed fortifications. Unthickened fuel can be used effectively to ignite combustable material, such as dry vegetation, and to produce casualties when used against fortifications where the openings are large enough for the billowing fuel to enter.

1-5. Targets for Flame Attack

a. General. In selecting targets for flame attack, consideration must be given to the type of flame weapon available and, in the case of the flamethrower, the appropriate fuel for the type of target to be attacked. Table 1-1 shows targets suitable for flame attack and the expected effectiveness of flame weapons and fuel for firing against specific targets.

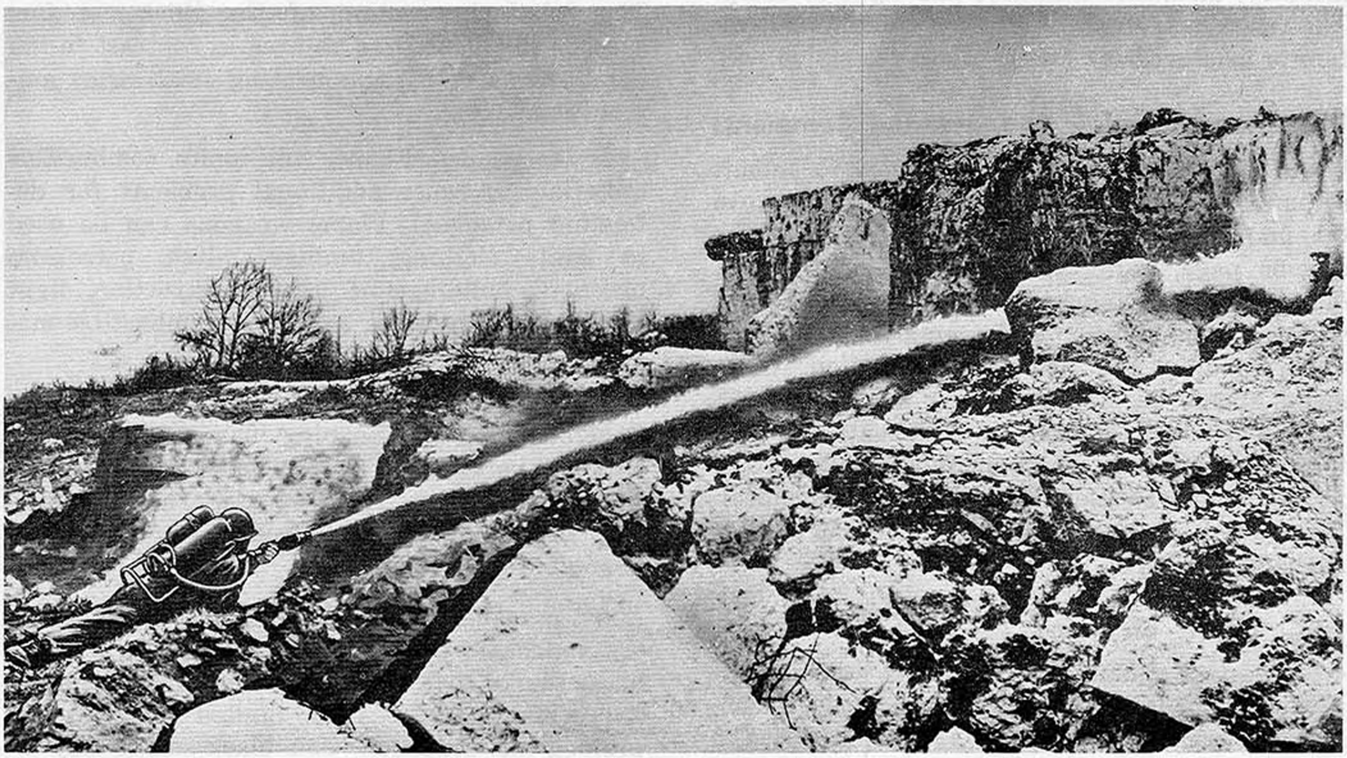


Figure 1-1. Firing with thickened fuel.

CHAPTER 2

GROUND FLAME OPERATIONS

2–1. Principles of Ground Flame Employment

a. General. Ground flame weapons/munitions are employed for both antipersonnel and antimateriel effects. This principal use in offensive operations is to reduce fortifications, suppress fire, and produce casualties or expose enemy personnel to the fire of other weapons. In defensive operations they are used to complement other weapons in fire plans. They can be used in stability operations to destroy buildings and equipment, clear tunnels, destroy food, clear light vegetation, counter ambushes, illuminate defensive areas, warn of enemy approach, and restrict enemy use of trails and paths.

★*b. Tactics.* Flame assumes great importance in ground warfare against an enemy whose tactics place emphasis on mass in the attack and stubborn, unyielding resistance in the defense. Even in relatively fluid, rapidly changing situations, an enemy may be able to establish excellent defensive fortifications, the reduction of which will require increased use of flame. Flame weapon tactics conform in general to basic infantry and armored principles of fire and maneuver. The tactical use of flame weapons in conventional attacks depends on the effective application of the principles of employment peculiar to the type of weapon being used. Employment techniques are different for each type of flame weapon because the characteristics of the weapons are different. Both portable and mechanized flamethrowers, though mainly attack weapons, can be used in the defense. The mechanized flamethrower is more effective than the portable flamethrower in defensive situations because of its greater range. Flame field expedients are used primarily in the defense. The XM202 rocket launcher can be used in both offensive and defensive roles because of its light weight, great range, and minimal service requirement. The decision to use flamethrowers, flame field expedients, or rocket launchers is based upon their availability and comparative effectiveness for the particular mission. In planning the attack, the commander considers the use of flame as a part of his plan for fire support. Defensively, flame weapons may be used in the coordinated plan for fires and in support of the counterattack. Flame can often be used to blunt and disrupt mass enemy attacks, but the disadvantages of flame in both defensive and offensive operations must be considered. Careful planning and coordination are needed for maximum benefit from the use of flame in the attack or defense.

c. Ground Flame Munitions and Equipment. Portable flamethrowers, mechanized flamethrowers, flame field expedients, and rocket launchers can be used to provide flame support in the offense or defense.

★(1) Portable flamethrowers are TOE equipment of the infantry battalion. These weapons are used by infantrymen trained to fire them as a secondary weapon. Two men per rifle squad should fire for qualification, and the remaining men should fire for familiarization. See appendix B for familiarization and qualification firing courses.

(2) The main armament for the Army standard mechanized flamethrower is the M10–8 flame unit. This flame weapon system is mounted in a modified M113A1 armored personnel carrier (APC) to produce the M132A1 self-propelled flamethrower. Another mechanized flamethrower, presently used by the Marine Corps, is the M67A1 flame tank. This flame weapon system consists of the M7A1–6 main armament mechanized flamethrower mounted in a modified M48A2 main battle tank. Mechanized flamethrowers are manned by personnel specially trained to operate them as a primary duty. The crewmen must be capable of firing flame guns and machineguns as well as driving the vehicle. See appendix C for mechanized flame gunnery courses.

(3) Servicing portable and mechanized flamethrowers includes pressurizing the pressure containers and filling the fuel tanks. Both types of flamethrowers are serviced with truck-mounted or tracked-vehicle mounted service units. Portable flamethrowers also can be pressurized with portable compressors.

(4) Infantrymen are trained in the construction, installation, and use of flame field expedients. As a general rule, at least one man in each squad should receive specialized training on flame field expedients.

(5) The XM202 rocket launcher is authorized on the same basis as the portable flamethrower. At east two men in each platoon authorized the rocket launcher should be trained to fire the weapon. Servicing requires normal operator maintenance and resupply of ammunition.

(6) In addition to the flame munitions discussed above, incendiary grenades can be used to damage or destroy materiel and to ignite the flame fuel of flame field expedients.

2–2. Use of Flame in the Offense

★*a. General.* Flame has many qualifications as an offensive assault weapon. It demoralizes, produces casualties, and ignites combustible material; and it has good searching capability through its splattering action. When combined with infantry, tanks, and supporting fires, flame contributes greatly to the accomplishment of the mission. It is particularly effective when combined with infantry fires during the last stages of the assault. Flame weapons can be decisive against an enemy lacking any tank or fire support other than automatic weapons. The limitations of the portable flamethrower stem directly from its range, fuel capacity, and weight. Terrain may limit the use of mechanized flamethrowers and rocket launchers. The doctrine prescribed in FM 7-10 for the offense and defense is applicable to flame weapons.

b. Attack Planning. Plans should be as simple and direct as possible. The following basic principles of employment are applicable in planning for the use of flame weapons in the attack:

(1) *Organization.* As assault weapons, flamethrowers and XM202 rocket launchers must be readily available to the unit requiring them. In daylight attacks, flame teams may be formed by using either the portable flamethrower or the rocket launcher within the rifle platoons or squads. Mechanized flame sections may be attached to battalions or companies. For the team to be effective, personnel using these weapons must be trained in their capabilities and limitations and must be further trained as a part of the team. Operations involving the portable flamethrower are coordinated at company level. Portable flamethrowers must be refueled and reserviced at battalion level, where compressors and service kits are available. Rocket launchers and sufficient ammunition may be carried by the infantry platoons or company or may be held in reserve at battalion level.

(2) *Intelligence.* Intelligence information, such as the size and nature of the objective and the terrain and the tenacity and disposition of the enemy, enables the commander to determine how much flame and what type of weapon he needs to accomplish his mission.

(3) *Reconnaissance.* As with other weapons, a proper reconnaissance is a must for successful employment of flame weapons. The target and any element supporting it must be located; a route of approach that offers protection from enemy fire must be selected; and the amount of flame required and the need for demolition and breaching support must be determined. For mechanized flame vehicles, reconnaissance of the path of advance must consider mines, obstacles, and the trafficability of soil or terrain. Much time can be saved if the commander of the supported unit understands the characteristics and capabilities of mechanized flamethrowers sufficiently well to carry out a preliminary reconnaissance for these vehicles. Time can also be saved if the commander of the mechanized flamethrowers moves with the forward unit commander so that he can complete his reconnaissance while the flame vehicles are coming up. Normally, the flame vehicles remain in reserve until a target is found for them. They can be committed to action without a thorough reconnaissance, but this risk must be evaluated on the basis of the existing situation and the necessity for expedited action. The XM202 rocket launcher can be employed without a thorough reconnaissance if the restrictions as to the rear danger zone and the minimum safe range are observed.

(4) *Isolation of the target.* When the reconnaissance is completed and the target is selected, it is necessary to isolate the target. Since the fire and smoke of the flame weapon will attract fire from enemy supporting positions, the area of flame attack should be isolated from observation and fire whenever possible. This isolation may be accomplished by the use of smoke to reduce observation by enemy positions most likely to interfere. Artillery and mortars can be used to neutralize enemy positions on the flanks and in

b. Mechanized flamethrowers normally flame the objective in advance of the infantry and are used first when both portable and mechanized flame weapons are used against the same objective.

2-5. The Attack

a. Movement to the Line of Departure. Portable flamethrower gunners may cross the line of departure by any one or any combination of the following:

(1) Stealth during reduced visibility and infiltrating to the final coordination line.

(2) Moving under the cover of close-in supporting fire.

(3) Accompanying their squad as part of the assault element.

★*b. Conduct of Attack.* Avenues of approach for mechanized flamethrowers must be over firm ground and terrain that will facilitate maneuver. They are selected to provide cover and concealment from direct fire. Fire superiority in the zone of action of the assault flame team is gained by intense fire of artillery, mortars, flame, and other supporting weapons, combined with intelligent, aggressive maneuver. The portable flame gunners are normally accompanied by extra gunners and security personnel, or obstacle-breaching personnel, or both. Portable flamethrowers should be used with the maneuver element. The infantry protects the flame action by providing fire support and security. Mechanized flamethrowers can be used as part of the base element to provide protective fire for the maneuver element.

c. Control. Control is most reliable when flamethrower gunners have been trained integrally with supported units and when action is preceded by a thorough reconnaissance and detailed planning. Once flaming begins, the problem of control is increased because of the rapid movement of the mechanized flamethrowers and their difficulty in maintaining direction and position in relation to one another and the supported unit. Reliable radio communication between flame vehicles themselves and between flame vehicles and the supported element is essential for control.

d. The Assault. The mechanized flame attack is timed to begin after flame vehicles arrive within effective range of the objective, and before supporting fires are lifted or shifted. Flaming begins at a predetermined fireline. Before and after flaming the target, the flame vehicle machinegun should be used to assist in providing assault fire, unless the flame vehicle has expended all its flame fuel and needs to return to the refueling point for additional fuel. The infantry assault follows the mechanized flame attack quickly and with constant, aggressive pressure. Portable flamethrowers may assault with the rifle squads, assault alone under cover of close-in direct fire, or assault by stealth.

e. Reorganization.

(1) Portable flamethrower operators remain on the objective with the unit to which they are attached in order to take part in reorganization and consolidation. Empty flamethrowers should be replaced immediately (from rear to front on a weapon-for-weapon basis) to provide for continuation of the attack. If time and materiel permit, flame field expedients can be emplaced to cover likely avenues of approach to the position.

(2) After mechanized flamethrowers have expended their flame fuel, they should move to a predetermined refueling point and be serviced as rapidly as possible. Preplanning the servicing of these flamethrowers is a means of insuring that they will be ready either to assist in the reorganization and consolidation of the objective or to continue the attack.

2-6. Use of Flame in the Defense

a. General.

★(1) The use of flame weapons/munitions can be a major factor in the successful defense of any position. Flame weapons are particularly effective in the final stages of the enemy assault. The short range of flamethrowers, however, restricts their employment and requires that they be carefully located to obtain the best advantage. The longer range of the rocket launcher increases that weapon's flexibility. Flame field expedients can be used to partly offset the limitations of flamethrowers.

(2) The following flame weapons/munitions can be used in the defense: portable and mechanized flamethrowers, XM202 rocket launchers, and flame field expedients. These weapons are integrated into defensive fire plans to supplement or reinforce other fires. Defensive flame fire plans may employ flame weapons uniformly within unit areas, massed at likely avenues of approach against anticipated massed enemy assaults, or may deploy them in reserve blocking positions ready for use in the counterattack. Particular attention is given to the resupply or replacement

of empty flame weapons to insure sustained support for the defense.

(3) Flame weapons/munitions are most effective when integrated into the plan for fire support and the barrier plan. They are used to supplement or reinforce other defensive fires or to defend a small sector not covered by other weapons.

b. Planning. The basic considerations of defense apply to the use of flame.

(1) *Proper use of terrain.* Flamethrowers and rocket launchers are located on key terrain on the perimeter of the rifle platoon defense areas. Flame field expedients may be emplaced in the gaps between platoons, in approaches to the position, or on key terrain forward of the battle position that the defending force does not plan to hold, and in blocking positions in depth.

(2) *Defense in depth.* Because of its limited range, the portable flamethrower can best be employed on the forward edge of the battle area (FEBA); however, flamethrowers organic or attached to reserve units remain with those units to provide depth to the flame defense. Flame field expedients are placed in likely areas of penetration. The use of these expedients is coordinated as outlined in paragraph 6–1. Mechanized flamethrowers, if held in reserve, materially assist during the counterattack phase.

(3) *Mutual support.* Mechanized flame weapons should be assigned final protective fires that will provide mutual support and increase the duration of flame effects as required. Final protective fires for mechanized flamethrowers should be coordinated by the unit commander to insure cover of assault approaches to provide a sustained, determined defense against massed assaults. Portable flamethrowers, because of their mobility and short range, should be prepared to attack and destroy enemy penetrations in a company sector. Flame field expedients should be emplaced so as to provide mutually supporting area coverage rather than isolated bursts of flame. These expedients may be used to fill gaps between indirect fire targets and to force or canalize enemy troops into final protective fires.

(4) *All-round defense.* Alternate and supplementary positions for flamethrowers aid the all-round defense. Flame field expedients may be positioned to protect the flanks and rear of the position.

★(5) *The fire plan.* Flame field expedients can be used to supplement the long-range and close defensive fires of mortars and artillery. However coordination is required to prevent duplication of effort and destruction of the flame field expedients by friendly fires. All types of flame weapons can be used with the final protective fires and with fires within the battle position to limit penetrations and support counterattacks. Flame field expedients can also be used in internal defense operations to counter ambush, clear underbrush, illuminate defensive areas, serve as warning devices, and inflict casualties on the attacking troops.

(6) *Flexibility.* Flexibility in the use of flame weapons is gained by preparing alternate and supplementary positions, and by using mechanized flame elements.

c. Reinforcement of Obstacles. Natural and artificial obstacles can be reinforced or extended by flame weapons. For example, flame fuel, which floats and burns on water can be used on shallow streams to prevent assaulting foot troops from crossing. Flame field expedients can be used as floating flame devices. Flame weapons or expedients must be used carefully to avoid damaging mines, prematurely detonating other flame devices in protective minefields, or destroying camouflage.

d. Antitank Measures. Armored vehicles can often move safely through flame fuel burning on the ground if the area is traversed quickly and the flames are not high enough to be sucked in through vents. However, flame fired directly on a tank can neutralize it by obscuring the driver's vision, seeping inside through vents, or setting the tank on fire. The minimum effect is profound fear and decreased efficiency of the tank crew. Flame field expedients may be located on probable tank approaches.

e. Brush and Forest Fires. Flame weapons must be used carefully to avoid starting brush and forest fires that may hinder the defense. When it is desirable to start fires deliberately, the following factors should be considered:

(1) Danger to friendly troops and installations.

(2) Probable effect on enemy operations.

(3) Effect on friendly observations.

(4) Effect on future friendly operations.

★CHAPTER 3

CHEMICAL MECHANIZED FLAME UNITS

3–1. General

Chemical mechanized flame units are combat units designed to provide mechanized flame combat support to maneuver elements. FM 3–1 contains details on the organization, equipment, capabilities, and duties of these flame units.

a. Organization of Flame Units. The units are—

(1) A section-size team (TOE 3–500) for support of a battalion or equivalent size force.

(2) A platoon-size team (TOE 3–500) for support of a separate brigade or a division-size force.

b. Support. These teams depend on the supported unit or some other source for administrative, mess, maintenance, and supply support.

c. Employment. For maximum effectiveness, mechanized flame units should be employed according to the guidance in chapter 4.

d. Training. The units should be trained with the unit they are to support.

3–2. Capabilities

a. These units can provide the following additional support, employing organic equipment on a priority basis established by the commander of the supported unit:

(1) Prepare and fill flame field expedients.

(2) Refuel, pressurize, and service portable flamethrowers.

(3) Decontaminate essential areas by burning.

(4) Destroy enemy supplies and equipment by burning.

(5) Assist in clearing minefields and areas by burning vegetation.

b. These teams are adaptable enough to provide other chemical combat support such as employment of riot control agents and chemical munitions.

3–3. Equipment

a. Mechanized flame units are equipped with transportation, communications, flame weapons, fuel mixing service units, and other equipment to provide the flame support the supported unit needs to accomplish its mission.

b. The units are 100 percent mobile in organizational transportation. Personnel are authorized weapons required for a coordinated defense of the unit area or installation.

c. These teams are equipped with FM voice radios to provide communications for command and control of their flamethrowers during combat operations and communications with the supported unit. Each flamethrower carrier is equipped with a radio set. Carriers also can use visual communications such as pyrotechnics and arm signals. The section-size team does not have a telephone, but the platoon-size team is equipped with a telephone set and cable to tie in with either the supported unit or the area signal system.

d. The section-size team is equipped with three mechanized flamethrowers and one service unit. The platoon-size team is equipped with nine mechanized flamethrowers and three service units. Each of these teams is equipped with a 600-gallon trailer-mounted gasoline tank. The platoon-size team also has a 1,200-gallon gasoline tank truck.

CHAPTER 4

MECHANIZED FLAMETHROWERS

Section I. CHARACTERISTICS

4-1. General

a. The mechanized flamethrower has the primary mission of dislodging or destroying personnel in emplacements such as fortified positions, caves, tunnels, underground installations, and buildings that resist assault by other weapons. It has a secondary mission of destroying materiel. Mechanized flamethrowers should attack in conjunction with other ground attack weapons, which exploit the advantages gained by flame and provide the necessary supporting fires to these flamethrowers. Coordination and detailed planning with supported and supporting arms are of primary importance to the successful employment of mechanized flamethrowers.

b. The destructive, casualty-producing, and shock effects of mechanized flame weapons are the same as the corresponding effects of other flame weapons. However, a flame gun mounted in a highly mobile vehicle gives it capabilities and limitations different from those of other flame weapons and dictates differences in its employment. These differences do not alter the fact that all flamethrowers are primarily close-range assault support weapons. In the attack, mechanized flamethrowers are considered complementary, rather than supplementary, to the other fire support means available to the ground commander and must be integrated into the plan for fire support.

4-2. Mechanized Flame Weapons

The following mechanized flamethrowers are available:

a. M67A1 Flame Tank (fig 4-1).

(1) This is an integral-type mehcanized flamethrower in which the main armament of the M48A2 tank is replaced by the M7A1-6 mechanized flamethrower (fig 4-2). This flame tank is used by the Marine Corps. The characteristics of the M7A1-6 mechanized flamethrower are listed below.

(*a*) Range ......180 to 200 meters.
(*b*) Fuel capacity ...378 gallons.
(*c*) Duration of fire ....60 seconds continuous or a number of short bursts.
(*d*) Mobility ....Same as that of the M48A2 tank.

(2) For technical references on the M7A1-6 flamethrower, see the TM 3-1040-206-series.

b. M132A1 Self-Propelled Flamethrower (fig 4-3).

★(1) This Army standard flamethrower consists of flame fuel and air tank units mounted in the cargo compartment of an M113A1 APC and a flame gun cupola that replaces the commander's cupola. A 7.62-mm machinegun is mounted coaxially with the flame gun. The M10-8 main armament mechanized flamethrower is permanently installed in the M113A1 APC. Characteristics of the M132A1 self-propelled flamethrower are as follows:

(*a*) Range ......150 to 170 meters.
(*b*) Fuel capacity ...200 gallons.
(*c*) Duration of fire ....32 seconds continuous or a number of short bursts.
(*d*) Mobility ....Same as that of the M113A1 armored personnel carrier, amphibious and air transportable.

(2) For details on the M10-8 flamethrower, see TM 3-1040-209-12.

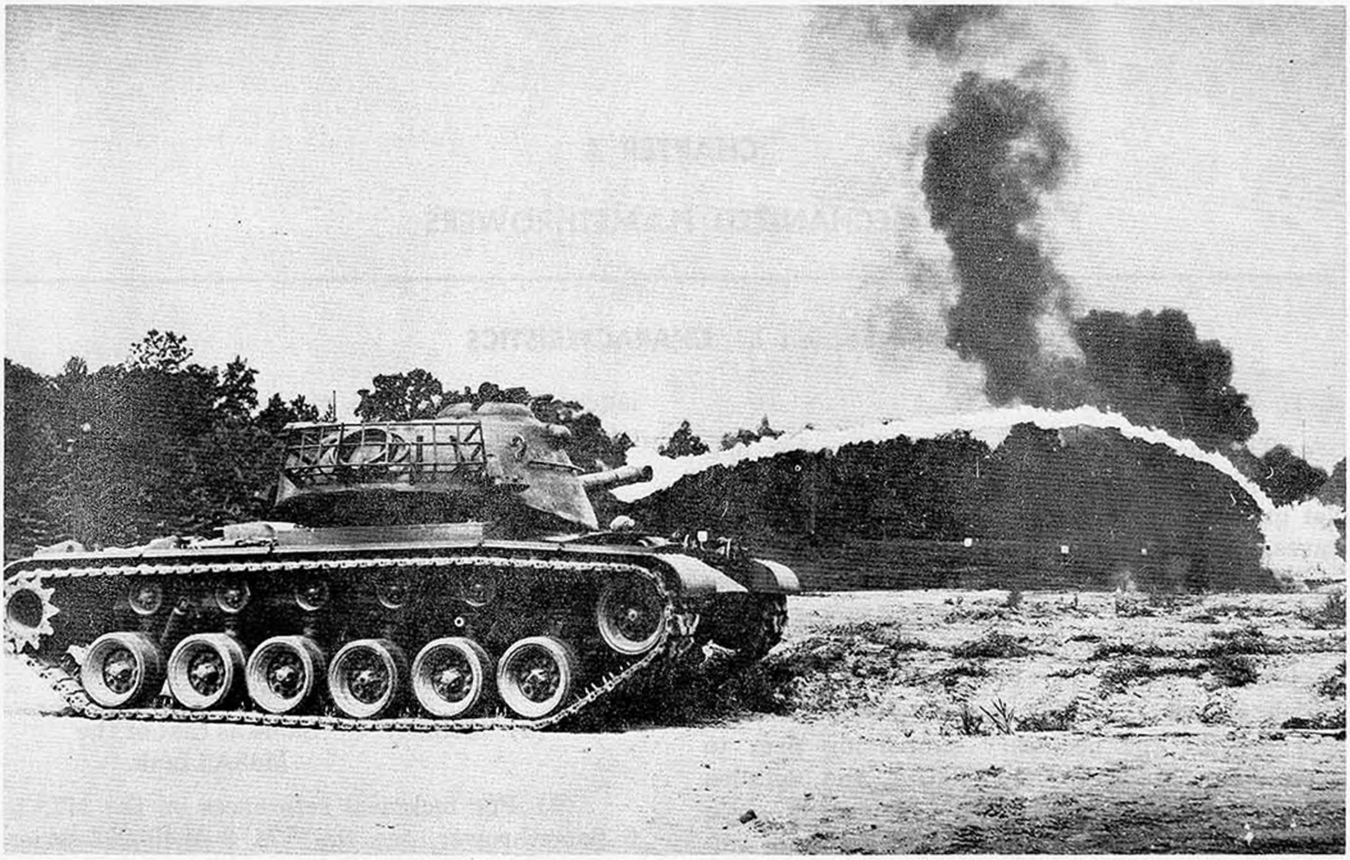


Figure 4–1. M67A1 flame tank.

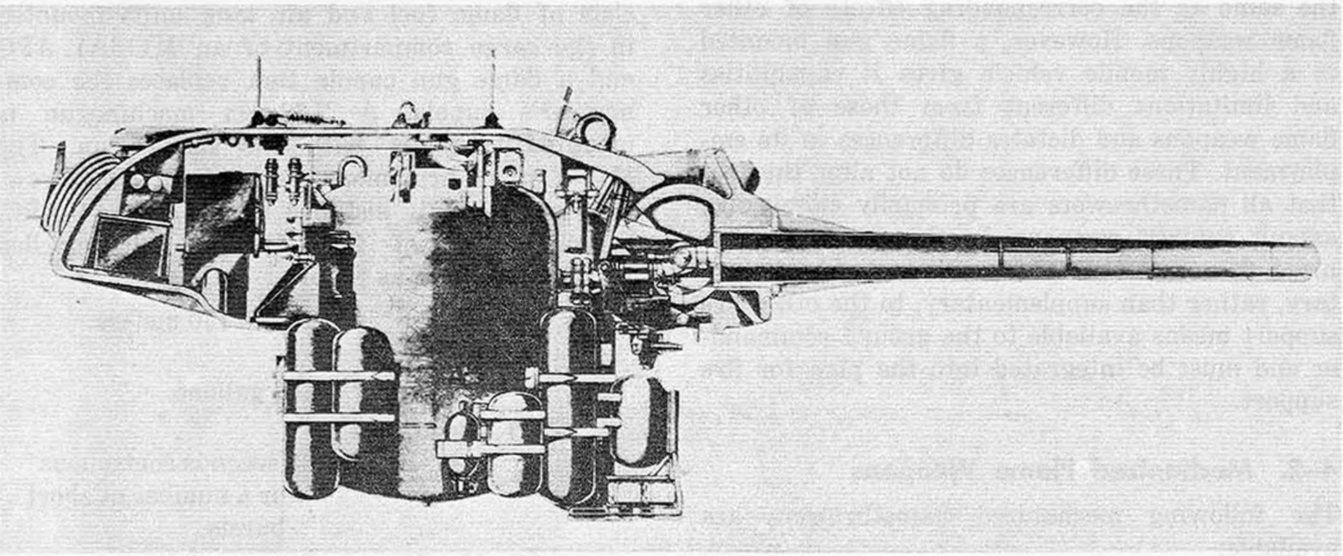


Figure 4–2. M7A1–6 mechanized flamethrower.

4–3. Servicing

★Servicing of mechanized flamethrowers is accomplished by units authorized the M4A2 service unit (fig 4–4) or the M45 service unit (fig 4–5). Each service unit contains a 200-gallon fuel mixing tank and an air compressor. The compressor supplies air at 3,000 pounds per square inch for pressurizing mechanized flame-

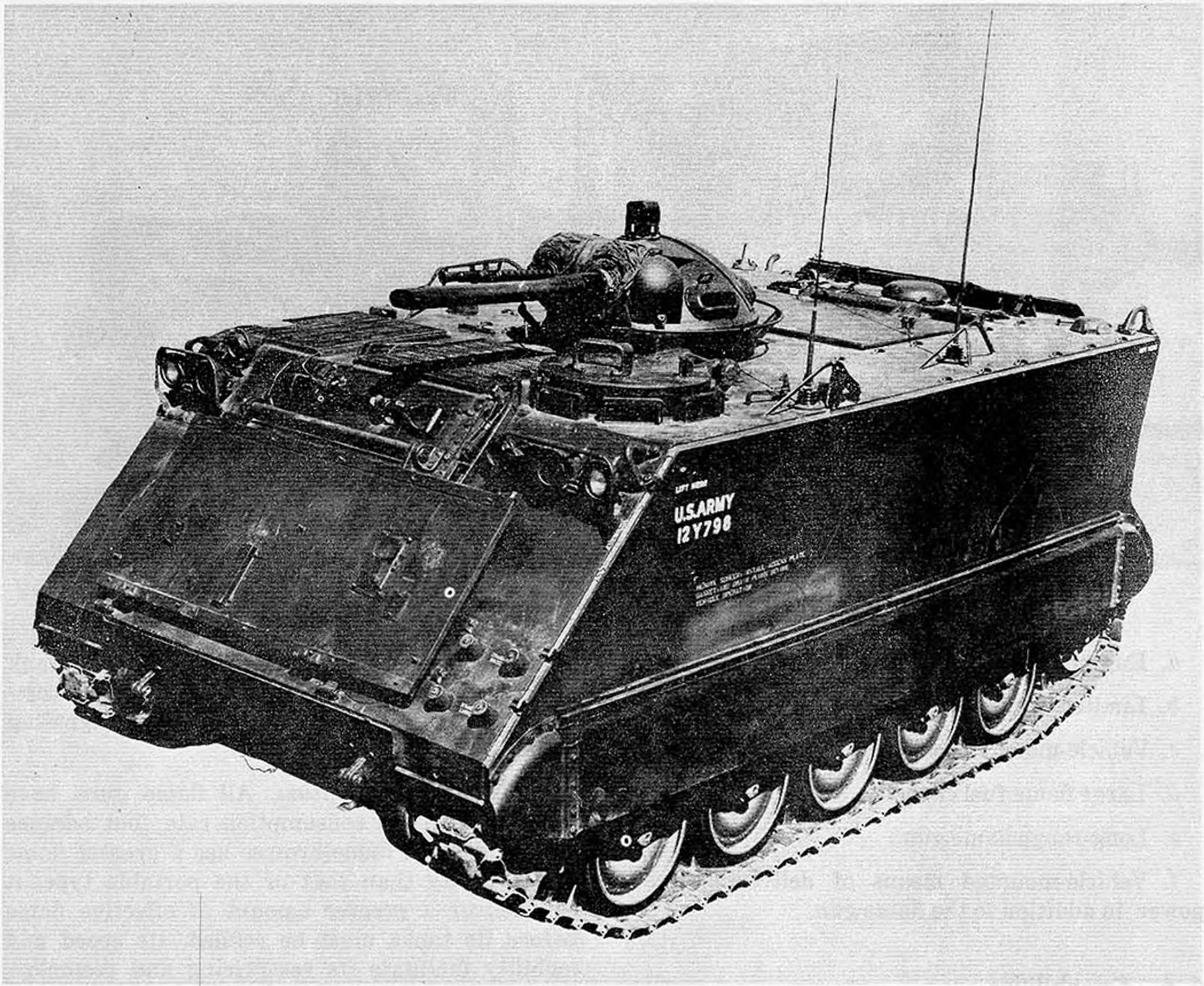


Figure 4–3. M132A1 self-propelled flamethrower.

throwers and at 2,000 pounds per square inch for pressurizing portable flamethrowers. The service units mix thickener with gasoline and pump the thickened fuel into flamethrowers, flame field expedients, and (when necessary) firebombs. These units are capable of preheating gasoline for fuel mixing in cold weather. The M4A2 service unit is mounted in the back of a modified 2 1/2-ton 6x6 truck. The M45 service unit, a standard-B item, is mounted on a removable pallet installed in the hull of a semiarmored M548 tracked cargo carrier. This tracked-vehicle mounted service unit provides armor protection, mobility of operation over cross-country terrain and improved roads, and amphibious operations on lakes and streams. In addition, the M45 service unit has two 100-gallon storage tanks for transporting unthickened fuel; this permits a total servicing capacity of 400 gallons. Refer to TM 3–1040–219–12 for additional M4A2 service unit data and to TM 3–1040–256–12 for additional M45 service unit data.

4–4. Gunnery Techniques

Gunnery techniques, training requirements, and the gunner's test for the mechanized flamethrower are contained in appendix C.

4–5. Common Characteristics

Mechanized flamethrowers have the following common characteristics:

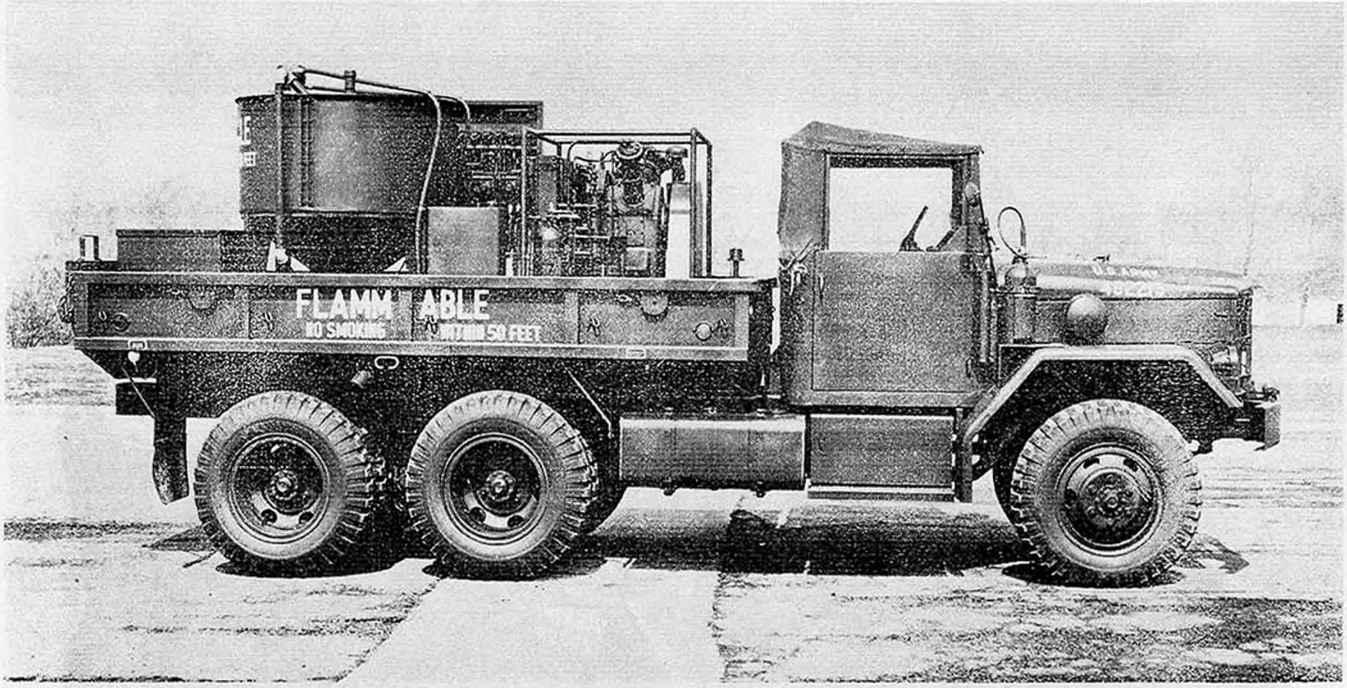


Figure 4–4. M4A2 truck-mounted flamethrower service unit.

a. Engine-powered mobility.

b. Limited armor protection.

c. Vehicle-mounted communication facilities.

d. Large flame fuel capacity.

e. Long-range flame gun.

f. Vehicle-mounted means of delivering firepower, in addition to the flame gun.

4–6. Capabilities

a. Battlefield Mobility. Because of their engine-powered mobility, mechanized flamethrowers have good battlefield mobility. They are no more sensitive to terrain than are other armored vehicles in the infantry-tank team, and the mechanized flamethrower operators are less vulnerable to artillery and mortar fragmentation and small arms fire than are portable flamethrower operators.

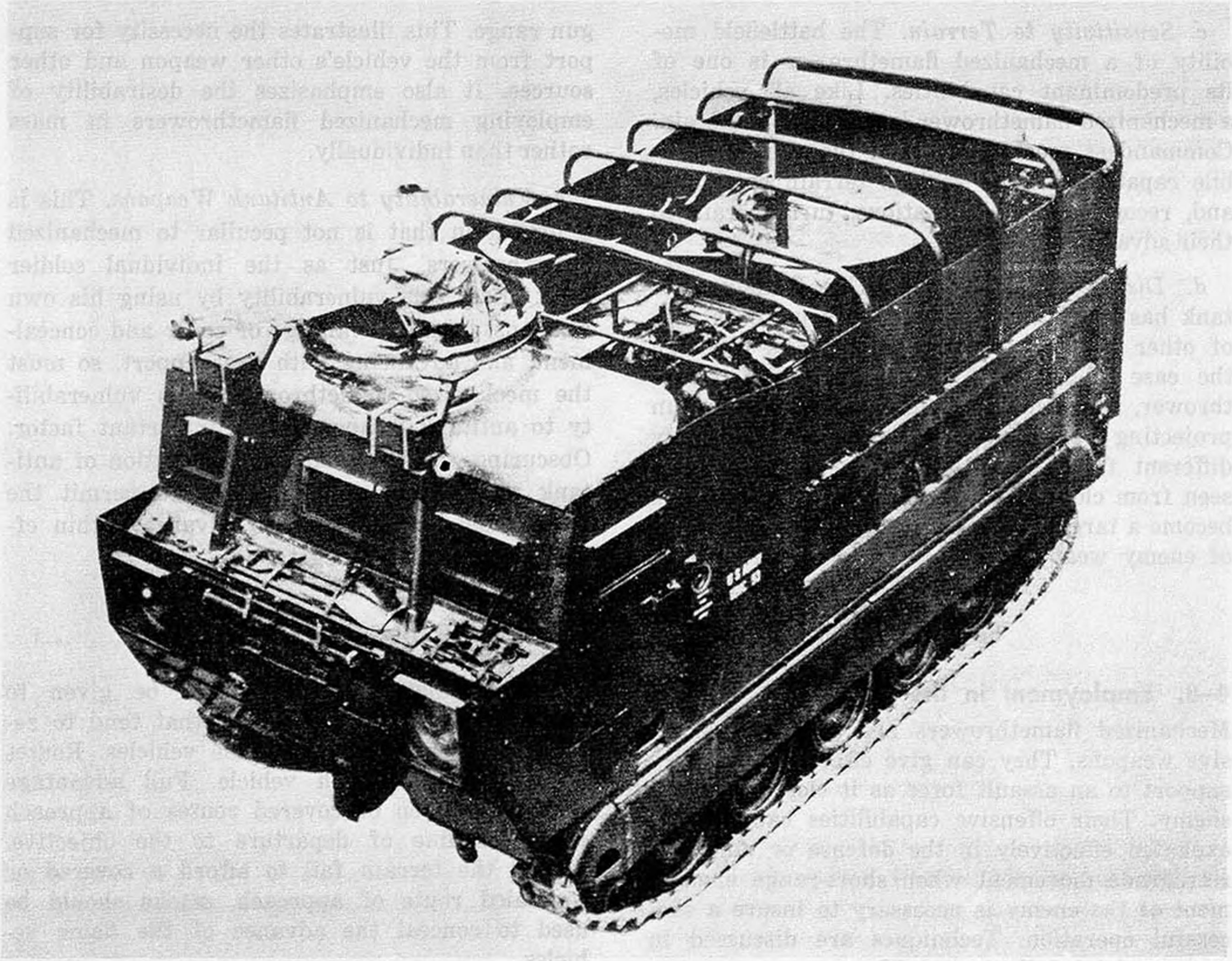
b. Battlefield Survival. Their speed, maneuverability, ability to travel over rough terrain, armor protection, integral automatic weapons, and flame gun range all provide mechanized flamethrowers with the basic necessities for battlefield survival.

c. Effective Communications. Mechanized flamethrowers have radio communication means that facilitate their control within the infantry-tank team. They are also equipped with visual communication means such as pyrotechnics, signaling panels, and flag sets.

d. Sustained Operation. All flame guns have a high flame fuel consumption rate; but because the mechanized flamethrower has a greater flame fuel capacity than that of the portable type, it can deliver a greater amount of effective flame before its tanks must be refilled. Its speed and mobility facilitate its reservicing and reemployment. Its capability of sustained operation should not be measured in seconds or minutes of continuous firing, but by the number of effective flame bursts (shots) that it can deliver (4 or 5 bursts of 6 to 8 seconds duration). In other words, each flame burst should be thought of as a round of ammunition.

e. Comparatively Long-Range Flame Delivery. The range of the flame gun in a mechanized flamethrower can be considered long only in comparison with the range of a portable flamethrower. Its maximum effective range is approximately 150 to 170 meters.

f. Shock Action. Any armored fighting vehicle has shock-producing capabilities. When these are combined with the psychological impact of flame (delivered in conjunction with the fire of the vehicle's automatic weapon during supporting



★*Figure 4-5. M45 tracked-vehicle mounted flamethrower service unit.*

airburst artillery fires and following preparatory support fires), the shock action of a mechanized flame attack can be decisive.

4-7. Limitations

a. Limited Range. Although the mechanized flame gun has a greater effective range than that of a portable flame gun, it still falls in the short-range class. Further, the trajectory of the projected flame fuel is readily influenced by wind. These limitations make it necessary that the gunner get near his target and allow for wind velocity and direction. To be most effective, a mechanized flamethrower must have fire support from other weapons during and before the assault so that it can move within flame range of its target. (Flame gunners must be trained to hold their fire until they are within effective range.)

b. Limited Flame Fuel Capacity. The high flame fuel consumption rate of all flamethrowers makes the weapon's capacity a critical factor. The larger its capacity, the greater number of effective flame bursts it can deliver. Commanders must consider this factor in their planning. This limited fuel capacity is the chief reason why mechanized flamethrowers have other vehicular-mounted weapons that remove them from the single-purpose class and enable them to lend additional assault support and to protect themselves. It is also another reason why they must be supported by other weapons so that they can withdraw under covering fires in order to refuel and rejoin the fight. A reservicing plan that takes advantage of mobility of both the flamethrowers and their service units is a necessary part of the plan for their tactical employment. Flame gunners must be trained to use the best type of burst for each target engaged.

c. Sensitivity to Terrain. The battlefield mobility of a mechanized flamethrower is one of its predominant capabilities. Like all vehicles, a mechanized flamethrower is sensitive to terrain. Commanders must understand the vehicle's mobile capabilities over various terrain conditions and, recognizing its limitations, turn terrain to their advantage.

d. Distinctive Silhouette. The flamethrower tank has essentially the same silhouette as that of other tanks until the flame gun is fired. In the case of the M132A1 self-propelled flamethrower, the flame gun and coaxial machinegun projecting from the cupola make it look distinctly different from other ACP's, particularly when seen from close, lateral ranges. This vehicle will become a target as soon as it comes within range of enemy weapons, most of which exceed flame gun range. This illustrates the necessity for support from the vehicle's other weapon and other sources. It also emphasizes the desirability of employing mechanized flamethrowers in mass rather than individually.

e. Vulnerability to Antitank Weapons. This is a limitation that is not peculiar to mechanized flamethrowers. Just as the individual soldier must offset this vulnerability by using his own weapons, taking advantage of cover and concealment, and advancing with fire support, so must the mechanized flamethrower. This vulnerability to antitank weapons is an important factor. Obscuring, neutralization, or destruction of antitank weapons must be planned to permit the mechanized flamethrower to advance within effective range of the target.

Section II. EMPLOYMENT IN THE OFFENSE AND DEFENSE

4–8. Employment in the Offense

Mechanized flamethrowers are primarily offensive weapons. They can give effective, close fire support to an assault force as it closes with the enemy. Their offensive capabilities can also be exploited effectively in the defense or during a retrograde movement when short-range engagement of the enemy is necessary to insure a successful operation. Techniques are discussed in paragraphs 4–9 through 4–12.

4–9. Principles of Employment

General principles of employment are given in chapter 2. Those particularly applicable in mechanized flame operations are as follows:

a. Organization. Mechanized flamethrower elements participating in an attack should be trained with the supported unit. If time permits, attacks should be rehearsed on terrain similar to the terrain for which the attack is planned. The rehearsal should employ all or as many of the attack-participating troops as possible. If time does not permit a rehearsal, troops selected should have previously participated in a flame attack. Extensive training must be conducted to familiarize all participating troops with combat flame operations. They must be so conditioned that they will not hesitate to follow up the flame attack. The success of the attack depends on the exploitation by supported ground troops.

b. Reconnaissance. Reconnaissance should be as detailed as time and the enemy situation permit. Particular attention should be given to natural and artificial obstacles that tend to reduce the mobility of the flame vehicles. Routes are planned for each vehicle. Full advantage should be taken of covered routes of approach from the line of departure to the objective. Should the terrain fail to afford a covered or concealed route of approach, smoke should be used to conceal the advance of the flame vehicles.

c. Effective Fire Support.

(1) Although mechanized flamethrowers are support weapons themselves, they must receive support from other weapons. This means that their own fires are included in the commander's plan of supporting fires. Supporting fires from other weapons are requested and planned, with the following missions in mind:

(*a*) Neutralization and/or destruction of antitank weapons on the objective and on neighboring terrain commanding the approaches to the objectives.

(*b*) Obscuring enemy observation until the flamethrowers are within effective flame gun range. Smoke can be effective for this purpose.

(*c*) Protective airburst artillery fire over the mechanized flamethrowers during their advance to their targets.

(*d*) Artillery and mortar fire on enemy personnel flushed out by the flame attack. These missions are planned on routes of withdrawal to the flanks and rear.

to the front as the attack progresses, it will provide illumination and prevent the attacking forces from becoming silhouetted by the flame still burning from the rear. Flame may also be used advantageously at night for reconnaissance by fire and decoy tactics.

f. Attack in Jungles. The opportunity to employ mechanized flamethrowers in mass seldom arises during jungle operations. Usually, in this environment, small flamethrower elements are attached to infantry units and employed as in normal operations except for changes necessitated by reduced visibility. The operation must be planned in detail because control is difficult.

g. Attack in Mountainous Terrain. In mountainous terrain, the greatest difficulties are encountered in negotiating the terrain and in resupply. The opportunity to employ flamethrowers in mass seldom arises. Small flamethrower elements usually are attached to infantry units that will be used to reduce pillboxes, caves, and similar fortifications.

★*h. Attack in Riverine Areas.* The M132A1 self-propelled flamethrower has amphibious characteristics that allow it to provide mechanized flame support in most riverine areas. This flamethrower can be used to attack fortifications, counter ambushes, and force occupants from small tunnels and cave complexes. See FM 31-75 for additional information on the use of flame in riverine operations.

4-13. Employment in the Defense

a. Mobile Defense. Although mechanized flamethrowers are primarily offensive weapons, they may also be used to advantage in mobile defense. When so employed, the techniques discussed in paragraphs 4-9 through 4-12 (offense) apply. Mechanized flamethrowers may, however, be employed in a defensive position as a supporting weapon. When so employed, they should be located well forward to cover likely approaches of attack. Flame vehicles must be closely protected by infantry. Routes of withdrawal as well as alternate and supplementary positions should be selected.

b. Area Defense.

(1) Mechanized flamethrowers may be employed on the FEBA to cover avenues of approach. Flame vehicles must be closely protected by friendly forces and dug in wherever possible. Routes of withdrawal to permit refueling, as well as alternate and supplementary positions, must be selected. Mechanized flamethrowers employed on the FEBA may be attached down to company level, depending on the mission.

(2) Another suitable role for the mechanized flamethrower is within the reserve. When mechanized flamethrowers are employed as part of a counterattack force, the techniques discussed in paragraphs 4-9 through 4-12 (offense) apply.

c. Defense of Rear Areas. Mechanized flamethrowers may be effectively employed in the defense of rear areas in a general support role similar to that of other support weapons of the combined arms team. The technique of employment is the same as in other mobile roles. Two or more mechanized flamethrowers should be present with the force operating against guerrillas, infiltrating troops, and airborne units.

d. Special Operations. The principles of employment of mechanized flamethrowers apply to the defensive aspects of special operations. However, the technique of application varies according to the type of operation.

e. Retrograde Operations. The mechanized flamethrower may be used against massed attacks that threaten to overrun a defensive position. It may also be used as a supporting weapon in counterattacks designed to permit friendly forces to disengage and withdraw.

★*f. Desert Operations.* In desert operations the care and cleaning of mechanized flamethrowers is of particular importance. Details on the difficulties of preparing and storing thickened fuels in a hot climate are given in TM 3-366. Although there is a general lack of good cover and concealment, desert terrain is excellent for the employment of mechanized units. Mechanized flamethrowers are well suited to these areas. Since they can maintain the same speeds as tanks and other armored vehciles, they can blend with these vehicles to avoid detection as flame weapons. The tactics and techniques of desert operations are discussed in FM 31-25.

g. Operations in Snow and Cold Climate. Mechanized units generally have good mobility over flat to gently rolling snowy terrain. Mechanized flame weapons, tanks, and personnel carriers complement one another as far as ground mobility is concerned, and mechanized flamethrowers can be less readily identified as such when used with other mechanized vehicles. See FM 31-71 for a discussion of flame operations in a cold climate.

CHAPTER 5

PORTABLE FLAME WEAPONS

Section I. INTRODUCTION

5–1. General

There are two different types of portable flame weapons available: the portable flamethrower and the XM202 rocket launcher.

a. Portable Flamethrower. This weapon projects flame fuel from a pressurized container through a nozzle to the target. The projected fuel is normally ignited as it passes through the nozzle of the flame gun. The portable flamethrower is a close-support weapon that can be used to reduce fortifications, suppress fire, and produce casualties.

b. XM202 Rocket Launcher. This four-tube launcher fires a rocket containing a flame agent mixture that ignites on exposure to the air. The rocket warhead is equipped to detonate on impact. This launcher is a close-support weapon for use in neutralizing enemy gun emplacements and fortified positions, and in street and village fighting.

5–2. Employment of Portable Flame Weapons

a. Portable Flamethrowers. This short-range assault weapon is normally employed by infantry elements in the assault of the objective. Because of the vulnerability of the operator and the limited amount of fuel, it is often necessary to employ more than one portable flamethrower with the assault element. Although it is primarily an offensive weapon, the portable flamethrower can also be employed in the defense.

b. XM202 Rocket Launcher. This direct fire weapon has a greater range than the portable flamethrower and can be used in support of other flamethrowers or rocket launchers employed with the assault element. The rocket launcher provides greater flexibility than other flame weapons in both the offense and the defense.

Section II. PORTABLE FLAMETHROWERS

5–3. General

Available portable flamethrowers and their characteristics are as follows:

a. ABC–M9–7 Portable Flamethrower (fig 5–1). This is a lightweight portable flamethrower (procured by Marine Corps only) consisting of an aluminum frame, lightweight alloy fuel tanks, a pressure sphere, and the M7 gun group (fig 5–2).

(1) Weight ______50 pounds loaded.
(2) Range ________40 to 50 meters.
(3) Fuel capacity 4 gallons.
(4) Duration of fire ________5 to 8 seconds of continuous fire, or 3 to 4 short bursts.

★*b. M9A1–7 Portable Flamethrower* (fig 5–3). This standard-B item is an improved version of the M9–7 flamethrower. Modifications include an improved air pressure system, a cover assembly that fits on top of the tank group, and a holster for stowing the gun group. Issued with the flamethrower is a supply kit that contains four high-pressure sphere assemblies and two cans (two cylinders per can) of ignition cylinders. For additional information on the M9A1–7 portable flamethrower, see TM 3–1040–257–12.

(1) Weight ______52 pounds loaded.
(2) Range ______45 to 55 meters.
(3) Fuel capacity _4 1/4 gallons.
(4) Duration of fire ________6 seconds of continuous fire, or 3 to 4 short bursts.

c. M2A1–7 Portable Flamethrower (fig 5–4).

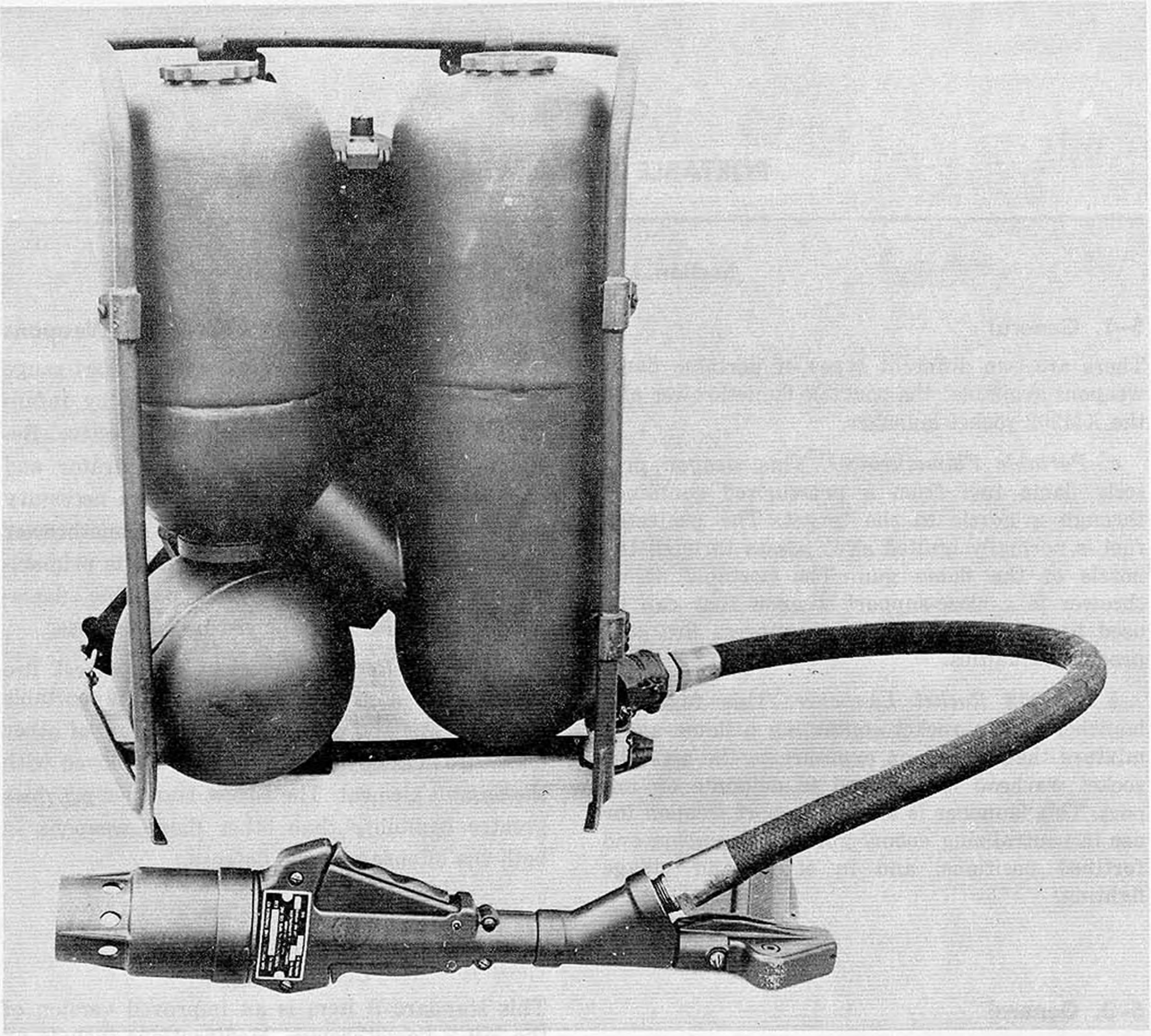


Figure 5-1. ABC-M9-7 portable flamethrower.

This flamethrower consists of a steel frame, fuel tanks, and a pressure tank. It uses the M7 gun group.

(1) Weight ....65 to 69 pounds loaded.

(2) Range ....40 to 50 meters (thickened fuel); 20 to 25 meters (unthickened fuel).

(3) Fuel capacity ..4 1/2 (+) gallons

(4) Duration of fire ....6 to 9 seconds of continuous fire, or 4 to 5 short bursts.

5-4. Servicing

★Servicing of portable flamethrowers includes filling the fuel tanks and pressurizing the pressure sphere or tank. Principal items of servicing equipment are compressors and service kits (figs 5-5, 5-6 and 5-7), which are TOE items of the headquarters and headquarters company of units authorized the portable flamethrower. The M4A2 or the M45 service unit can also be used to service portable flamethrowers. Servicing and resupply are a responsibility of the battalion commander, who controls the use of all portable flamethrowers in his command. Replacement of used flamethrow-

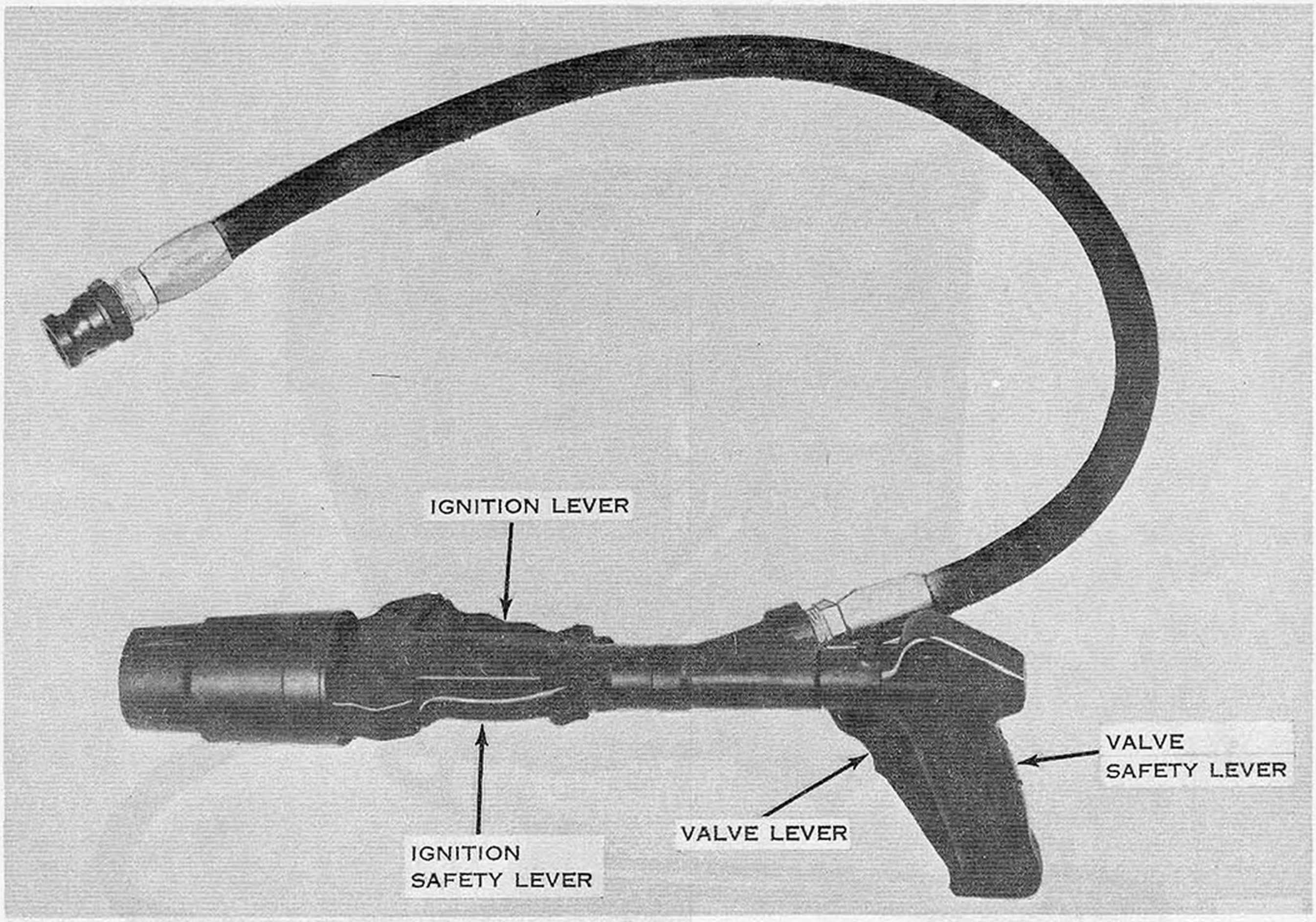


Figure 5–2. M7 flame gun group.

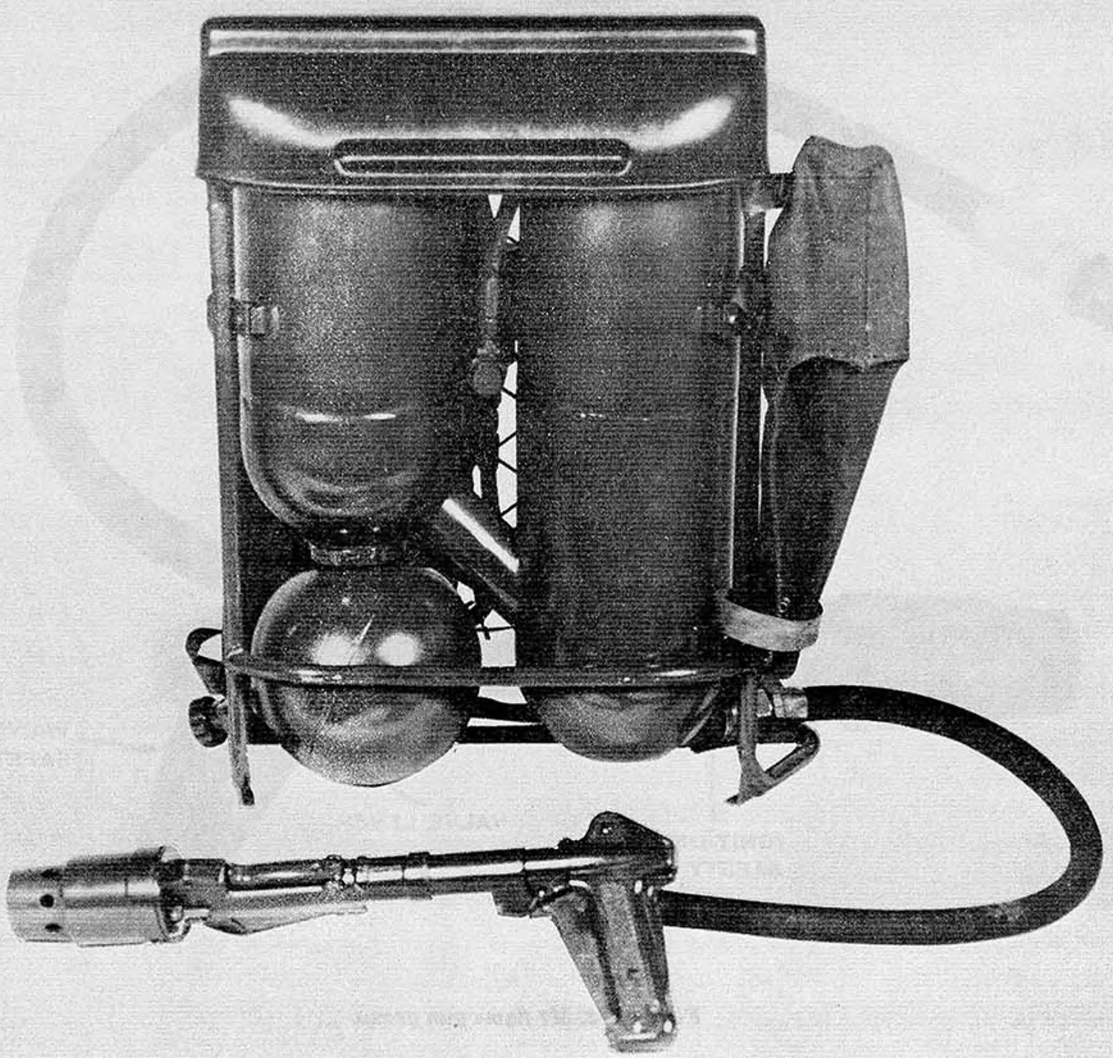
ers must be carefully planned to insure resupply of fully serviced flamethrowers from within battalion assets. Battalion headquarters and headquarters company personnel (assisted by flame gunners when necessary) service portable flamethrowers. If available, chemical service personnel (TOE 3–500) can provide this service. Portable flamethrowers can be serviced (exclusive of thickened fuel preparation) in about 15 minutes by using the AN–M4 compressor. They can be serviced faster by using the M4A2 service unit or compressed air cylinders. The flamethrowers should be serviced as far forward in the battalion area as practical. Thickened fuel may be prepared locally by hand-mixing procedures (TM 3–366) or by using any fuel service units available in the battalion area. Flame fuels can be provided from the rear area in containers ready for transferring to the flamethrowers as indicated in figure 5–8.

5–5. Gunnery Techniques

Gunnery techniques, training requirements, and the gunner's test for the portable flamethrower are contained in appendix B.

5–6. Capabilities and Limitations

a. Capabilities. The portable flamethrower is a man-portable weapon used primarily to attack fortifications and enemy strongpoints; it is also used in street and jungle fighting. It greatly demoralizes personnel subjected to attack by this weapon. The projected flame fuel can penetrate small openings and ricochet and splatter from wall to wall, spreading burning fuel over areas not accessible to the point effects of nonfragmenting small arms ammunition. The maximum range of the portable flamethrower is approximately 55 meters (less for unthickened fuel).



★*Figure 5–3. M9A1–7 portable flamethrower.*

b. Limitations. The portable flamethrower has a short range (20 to 50 meters, dependent on type of fuel) and a limited duration of fire (dependent on type of flamethrower and other limiting factors). Wind, terrain, and type of fuel determine to a great extent its effective range. Employment of heavier models is more limited in rugged terrain and in airborne and mountain operations when flamethrowers must be manpacked.

CHAPTER 6

FLAME FIELD EXPEDIENTS

6–1. General

Flame field expedients may be used for casualty effects, illumination effects, or signaling effects. These expedients include exploding flame devices, flame fougasses, and flame illuminators. Exploding fougasses may also be used as improvised flame mines. The flame field expedients discussed in this chapter have been used and found to be effective in combat. Variations and adaptations of these field expedients, designed to meet specific situations, are limited only by the imagination and initiative of combat personnel using them. For information on delivery of flame field expedient devices by Army aircraft, see paragraph 7–13.

a. Controlled Weapons. Flame field expedients initiated by the commander of the using unit are considered to be a part of the final protective fires of that unit. They are not reported as mines. However, unless the flame field expedients are turned over to another unit by mutual agreement, the using unit must detonate and remove them before leaving the area.

b. Uncontrolled or Contact Weapons. When exploding flame devices and flame fougasses are used for contact detonation by the enemy, they are considered improvised flame mines. Their locations are marked, reported, and recorded according to the procedures set forth in FM 20–32.

6–2. Tactical Uses

Flame field expedients are used chiefly in defensive operations; however, they may also be used in offensive operations. They may be used in all types of minefields: protective, defensive, barrier, nuisance, or phony. Tactically, flame field expedients are used to—

a. Warn of enemy approach. They are used in defiladed areas or during periods of limited visibility.

b. Produce casualties by splattering personnel with thickened fuel or by striking personnel with fragments of the container. The high radiant heat of the fireball will also cause casualties.

c. Deter the enemy by their psychological impact.

d. Produce limited battlefield illumination to silhouette the opposing force.

e. Restrict the use of most likely avenues of approach that cannot be covered easily by direct fire weapons. Exploding flame devices and fougasses can be used for this purpose.

f. Force the enemy into areas where he may be more profitably engaged.

g. Provide support of offensive operations. Flame field expedients may be used close to friendly positions, alone or with barbed wire or other obstacles. They may be used either by themselves or with high explosive (HE) and chemical landmines in composite minefields. When exploding flame devices are emplaced in composite minefields, the effects of flame on other obstacle components such as tripwires must be considered. If flame field expedients are to be placed in a field containing chemical mines, they must be emplaced so that the flame will not vaporize or burn the chemical agent.

6–3. Types

a. Exploding Flame Devices. An exploding flame device consists of a container, an incendiary fuel (usually thickened gasoline), and a firing system to scatter and ignite the fuel. The size of the area it will cover depends on the size of the container and the firing system. It may be detonated by the M4 incendiary burster (fig 6–1), or it may be detonated by some other available explosive used with the white phosphorus (WP) hand grenade, which serves as an igniter. There is no standard exploding device. However, experience indicates that claymore mine explosive components, which are waterproof, are less subject to explosive component breakdown

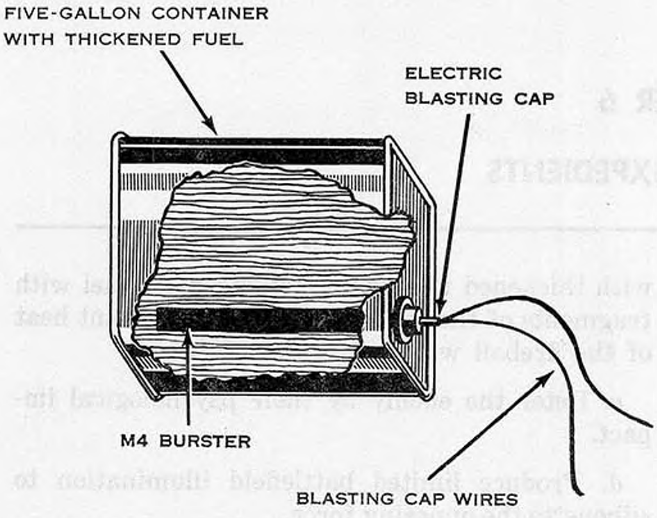


Figure 6–1. Exploding 5-gallon flame device with M4 burster.

than are most other explosive components used in flame field expedients.

(1) *Controlled type.*

(*a*) A 5- to 20-gallon metal container can be used (fig 6–1). It is emplaced on the surface or in a V-trench. The 5-gallon device, because of its weight and limited area of effect, may be rapidly emplaced by the individual or small unit as a close protective measure. A trench can be used to give some direction to the flame. A 5-gallon container will cover an area approximately 20 to 30 meters in diameter.

★(*b*) Large metal containers (usually 55-gallon drums) filled with thickened fuel may also be used. These weapons inflict casualties by the action of the burning fuel and flying pieces of the metal container. They have a great psychological effect. A 55-gallon container (fig 6–3 and 6–4) will cover an area approximately 85 meters in diameter. For maximum fragmentation effect, they can be wound tightly with barbed wire and engineer pickets (fig 6–5). Two 55-gallon containers welded together can provide an effective flame device.

(*c*) The M4 incendiary burster can be used with any container into which it can be inserted. One burster is sufficient for a 5-gallon container (fig 6–1). Bursters can be joined together to rupture larger containers. The 55-gallon drum requires a minimum of two bursters. The incendiary burster or bursting charge should be placed so as to throw the flame fuel up and out. These flame expedients produce some illumination.

(2) *Contact type.* All exploding flame devices can be emplaced for contact detonation as improvised flame mines. Since a lone enemy soldier usually detonates a contact device, a 5-gallon oil can containing thickened fuel is sufficient. The ignition system and the can itself may be wound tightly with barbed wire for fragmentation effects (fig 6–6). This weapon is most effective when emplaced in the open where obstruction will not decrease the fragmentation effect against personnel. Best results are obtained when it is emplaced in well-camouflaged positions approximately 2 meters above the ground in branches of trees, bushes, or hedges.

(3) *Hasty emplacement.* For hasty or overnight-type defensive operations (and in the absence of metal containers), holes may be dug in the ground, filled with previously thickened fuel, and fixed with an exploding device. If available, plastic containers or any suitable material may be used to line the inside and cover hasty flame field expedient emplacements. Depending on the size of the hole and on the amount of thickened fuel and explosive charge used, area covered will vary.

b. Flame Fougasses. The flame fougasse is a variation of the exploding flame field expedient in which the flame is projected by explosive means over a preselected area. The flame fougasse may also be used as a controlled weapon or an improvised flame mine. The container for this weapon may take one of several forms; for example—

(1) A metal cylinder or a propellant charge container (fig 6–7), open at one end, dug in, and firmly braced at an angle that will give maximum effect over the area selected for attack. Where terrain conditions (such as water or rocks) prohibit burying the container, it can be heavily sandbagged. It will project flame approximately 45 meters.

(2) A 5- to 55-gallon metal container emplaced in a V-trench (fig 6–8). Explosives placed behind the container give direction to the burning fuel.

(3) A hasty flame fougasse (without a metal container) for overnight-type defensive operations can be constructed in a manner similar to that described in (1) and (2) above. The range will be slightly reduced, however.

c. Flame Illuminators. A number of flame devices may be used to produce limited battlefield illumination. All flame field expedients give an initial flash from the detonation and ignition of

★*Figure 6–2.* **Rescinded.**

the thickened fuel. Thickened fuel thrown on the ground as a result of the detonation continues to burn for 5 to 10 minutes and provides some illumination. True flame illuminators are constructed to provide extended burning time with maximum illumination, although they may also produce casualties. Flame illuminators may be used for warning as well as illumination by contact detonation. Some improvised flame illuminating devices are discussed below. Others are described in FM 20-60.

(1) A 5- to 55-gallon drum filled with thickened fuel, tightly sealed, and set in a hole so that the top is slightly below ground (fig 6–9) can be used. Coils of detonating cord are wound around the inside edge of the top of the drum. The coil is tightly tamped with earth. When detonated, the cord cuts off the top of the drum and a white phosphorus hand grenade ignites the fuel. It burns for several hours. Time of burning can be controlled to some extent by the size of the container, by the thickness of the fuel mixture, and by the addition of straw or dirt. It cannot be easily extinguished without use of specialized firefighting equipment.

(2) A hasty flame illuminator, to be fired within 12 hours after emplacement, can be constructed by digging shallow holes or trenches in selected avenues of approach, filled with previously thickened fuel, and fixed with an igniter system.

(3) Water illuminators can be set up by pouring gasoline, oil, or thickened fuel on the surface of calm water and igniting.

(4) Illuminators for defense perimeters can be constructed by using No. 10 food cans, empty .50 caliber ammunition cans, or similar containers (fig 6–10). The container is half filled with sand and half filled with diesel fuel and covered with paper. A trip flare is used to ignite the fuel. The containers are strategically emplaced (with tripwires or wires for remote control) at 50-meter intervals within the forward edge of the defensive perimeter. Upon activation these illuminators will provide some illumination for about 45 minutes.

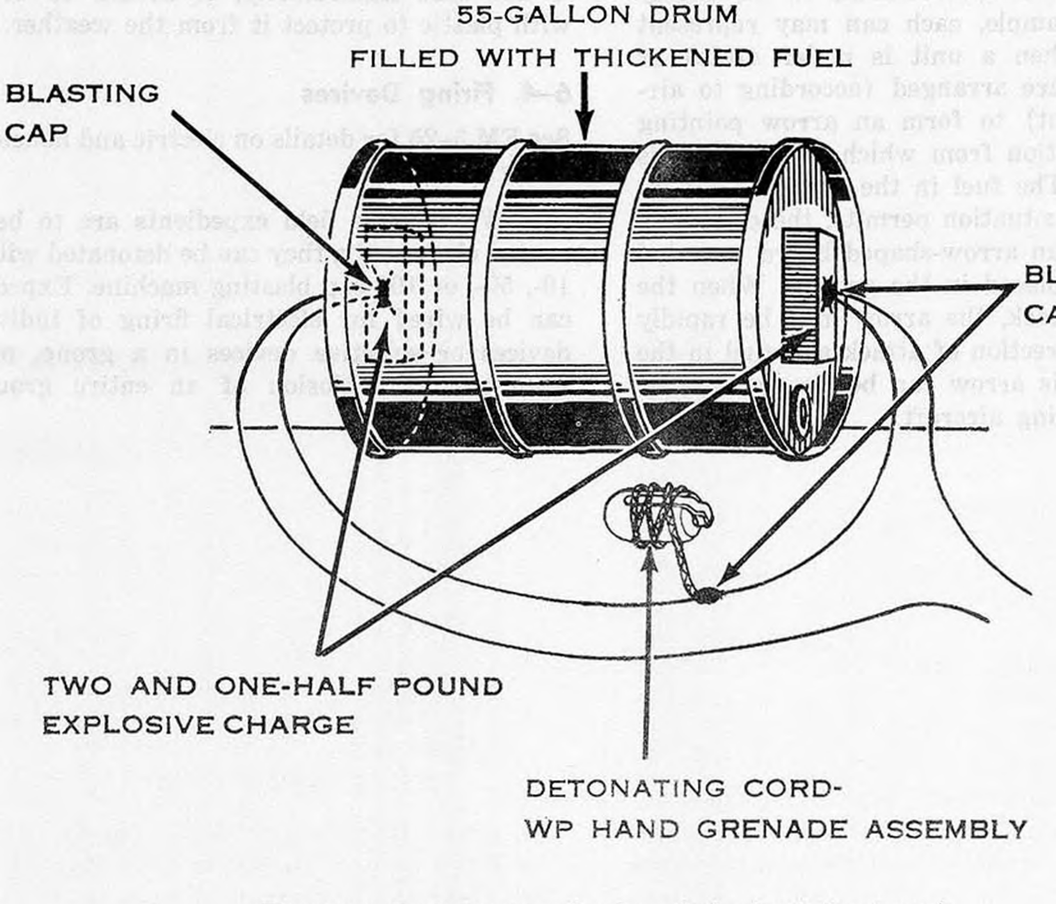

55-GALLON DRUM
FILLED WITH THICKENED FUEL
BLASTING CAP
BLASTING CAP
TWO AND ONE-HALF POUND EXPLOSIVE CHARGE
DETONATING CORD-WP HAND GRENADE ASSEMBLY

Figure 6–3. Exploding 55-gallon flame device (explosive charge).

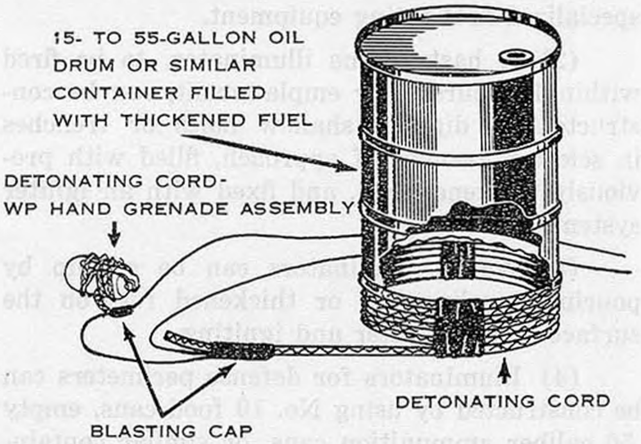

15- TO 55-GALLON OIL DRUM OR SIMILAR CONTAINER FILLED WITH THICKENED FUEL
DETONATING CORD-WP HAND GRENADE ASSEMBLY
DETONATING CORD
BLASTING CAP

Figure 6–4. Exploding 55-gallon flame device (detonating cord).

(5) An illuminated signal arrow (fig 6–11) consisting of a series of used individual ration cans filled with an equal mixture of diesel fuel and JP–4 (or equivalent) fuel may be used. The number of cans on the stem of the arrow indicates the number of meters/increments to the enemy location (for example, each can may represent 100 meters). When a unit is under attack at night, the cans are arranged (according to air-ground agreement) to form an arrow pointing toward the direction from which the position is being attacked. The fuel in the cans is then ignited. When the situation permits, the cans may be arranged on an arrow-shaped board mounted on a spindle emplaced in the ground. When the unit is under attack, the arrow may be rapidly pointed in the direction of attack and fuel in the cans ignited. This arrow can be clearly seen by pilots of supporting aircraft.

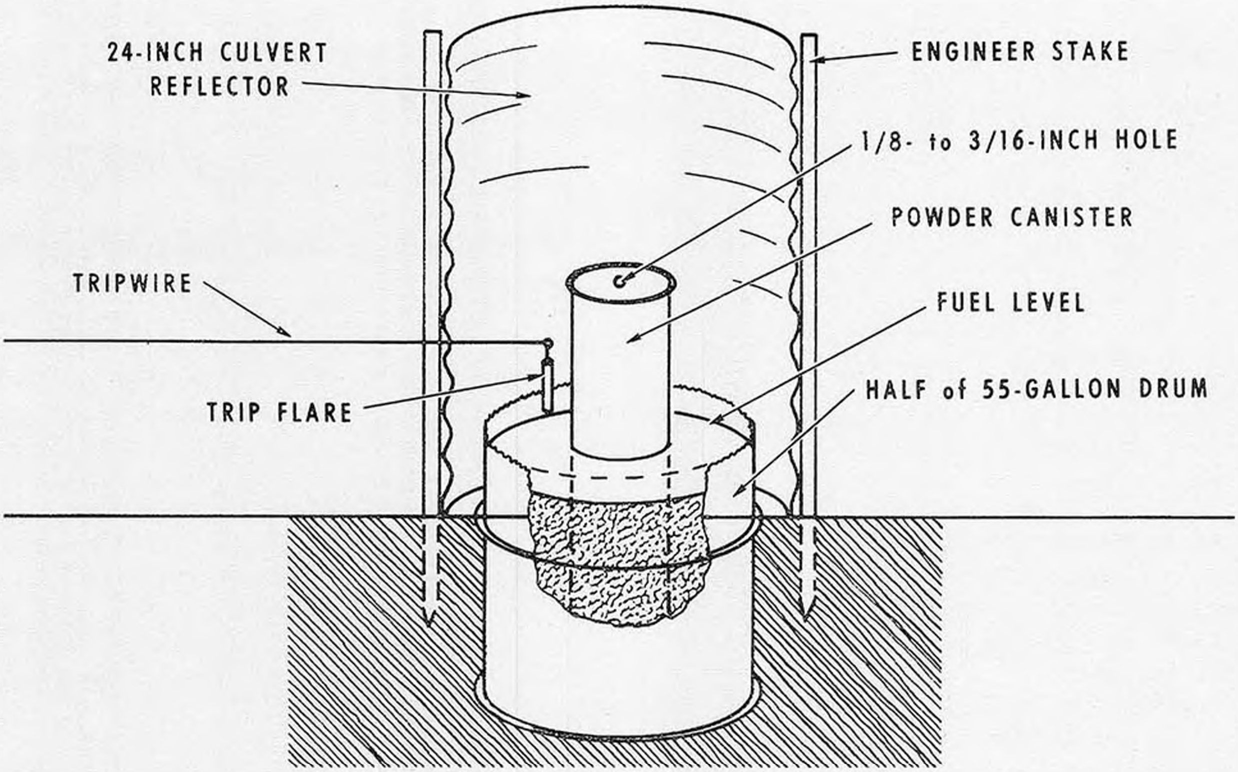
(6) Coating the water of canals, ditches, and moats with petroleum products and then command-igniting them can provide an effective illuminator and a formidable obstacle.

★(7) The Husch flare (described in FM 20–60) is an illumination device that uses the burning vapor of thickened flame fuel to provide illumination. The Husch-type flare (described below and illustrated in figure 6–11.1) also can provide illumination. This flare is a sealed metal container (powder canister) that is three-fourths full of thickened fuel and has a 1/8- to 3/16-inch hole in the top. The container is placed cap down in half of a 55-gallon drum that is three-fourths full of thickened fuel. When the fuel in the drum half is ignited, the heat from the burning fuel produces vapor in the powder canister; this vapor is expelled as a burning jet through the hole in the powder canister. A reflector assembly made from 24-inch culvert should extend about 60 centimeters above the top of the rim of the drum half. Fuel in the drum half can be ignited with a trip flare or WP grenade. This type of flare, which is reusable, will illuminate an area with a radius of about 50 meters for 4 to 5 hours. If the flare is not used immediately, it should be covered with plastic to protect it from the weather.

6–4. Firing Devices

See FM 5–25 for details on electric and nonelectric firing systems.

a. When flame field expedients are to be detonated electrically, they can be detonated with the 10-, 50-, or 100-cap blasting machine. Expedients can be wired for electrical firing of individual devices or selective devices in a group, or for simultaneous explosion of an entire group of devices.


24-INCH CULVERT REFLECTOR
ENGINEER STAKE
1/8- to 3/16-INCH HOLE
POWDER CANISTER
TRIPWIRE
FUEL LEVEL
TRIP FLARE
HALF of 55-GALLON DRUM

★*Figure 6–11. 1. Husch-type flare.*

CHAPTER 8

DEFENSE AGAINST FLAME

8–1. General

★Troops must be made to understand that the individual soldier can protect himself from flame. The most effective individual defense is to keep particles of burning fuel off the person by means of cover. Items of individual equipment offer protection against burning fuel. Foxholes and weapon positions can be modified to afford protection against any flame attack except a direct hit by a firebomb. See FM 5–15 for details on construction of foxholes and weapon positions. The application of proper individual measures plus aggressive unit defenses can make an enemy flame attack relatively ineffective.

8–2. Individual Protection

Individuals should be instructed to—

a. Use any available cover when a flame attack appears imminent. Foxholes and prepared positions are the most satisfactory, but shell holes and small depressions assist in reducing the hazards of burning fuel and offer some protection. If time permits, overhead cover should be used. A field jacket pulled up over the head and covering any exposed skin (such as face, neck, or hands) offers some protection against direct burns.

b. Remain covered with no skin exposed until after the flame bomb has burst in the vicinity and then throw off the cover and remove any burning particles from their clothing.

c. Use any of the following items of equipment for protection against burning fuel:

(1) Two thicknesses of the shelter half will hold burning fuel for more than 10 seconds.

(2) The field jacket and issue blanket offer almost the same protection when used as foxhole covers.

(3) Tent canvas and truck tarpaulins that have been treated with fire-resistant material will withstand direct hits with burning fuel and will hold the burning particles long enough (more than 30 seconds) for personnel to escape from the foxhole.

★*d.* Use foxhole covers improvised of brush. With as little as 5 centimeters of earth on top, these covers will withstand burning fuel.

***Warning:* The plastic or rubber-coated poncho should not be used as overhead cover because it will melt and adhere to the skin, causing injury or burns.**

8–3. Training

★*a.* Thorough troop indoctrination in the enemy's flame capabilities and limitations is essential. Proper mental conditioning, which leaves the individual soldier with the conviction that ground flame attacks can be repulsed, is the primary consideration in teaching defensive tactics. Commanders responsible for the training of troops must continually emphasize the difficulties the enemy will encounter in carrying out successful flame missions.

b. Stress is placed on the following:

(1) The amount of coordination required by the enemy to prepare for an attack.

(2) The difficulties of maintaining the initiative and the probable lack of control during the attack.

(3) Limitations of the flame weapon.

(4) Susceptibility to failure of the entire flame threat through destruction of key personnel or vehicles before they reach firing range.

(5) The high degree of accuracy necessary against small, well-camouflaged ports, even if the gunner should reach an assaulting position.

c. Troops must be trained to recognize enemy flame equipment and to recognize any indications that the enemy is preparing for a flame attack. Training also includes the enemy's technique of flame employment. Troops are alerted to preparations the enemy may make before the flame attack. By knowing these, friendly troops can anticipate the attack and prepare to defend against it.

8–4. Troop Attitude

a. The troop attitude is a paramount factor in the successful repulsion of a flame attack. A determined troop effort that incorporates a calm, calculating, and aggressive attitude is needed to destroy the flame threat.

b. One of the greatest dangers of a firebomb attack is its psychological impact, which may demoralize troops and cause them to defend their positions inadequately. Troops should be trained in defensive measures against firebomb attacks. These include the same measures prescribed for defense against other forms of air attack.

8–5. Mutually Supporting Defensive Positions

a. The best defense against both portable and mechanized flamethrower attacks is offensive action. Flamethrowers and their operating personnel should be destroyed before they get within effective range of their intended target. Mutually supporting defensive positions offer substantial assurance that this objective can be attained. Commanders responsible for the organization of defensive positions must pay particular attention to terrain in defilade of each position and to positions that offer some concealment from the attack. Positions in defilade often prove to be the best avenues of approach for the flamethrower gunner. Defending personnel should be warned that the attacker may prepare cover and concealment by using smoke or by using artillery or mortars to create shell craters leading to his selected assault positions.

★*b.* After it has been definitely established that a flame attack is about to be or has been launched, all personnel should be notified to fire on the attacking flamethrowers when they are within range. Reconnaissance by fires of supporting weapons can be effective in deterring the flame attack only if the general area of the flamethrower is known.

c. Personnel in foxholes, slit trenches, and other positions located near the intended target can be used effectively against a flamethrower attack. After the preliminary bombardment and when the flamethrowers come within range, these personnel must act quickly with rifle fire, grenades, or antitank weapons.

d. At the time of the actual flame attack, personnel under attack must take cover in available shelter. If caught in the open (with no shelter immediately available), troops are best protected by running at right angles to the direction of fire or at right angles to the direction of flight of the attacking planes.

8–6. Use of Supporting Fires

Supporting artillery and mortars and supporting air should be informed immediately of the location of enemy flame weapons. Destruction of these weapons has high priority in the fire plans of direct support artillery and mortars. Reinforcing artillery and mortar fires should be called for when large numbers of enemy weapons are participating in the attack. The maximum rate of fire is maintained (when the target is a mechanized flamethrower) until the threat of the attack is eliminated. Precision adjustment for the complete destruction of the flamethrower should follow when the vehicle is only damaged.

8–7. Passive Defense Measures

The best passive defense measure against flame is a foxhole or other shelter with overhead cover. The effectiveness of shelters against flame can be improved by the steps outlined below. They should be accomplished as the tactical situation and time permit.

a. Barriers. Artificial barriers (such as doors, false walls, or curtains) or natural barriers (such as curving passageways in caves or tunnels, side pockets, or protruding rock formations) within fortifications provide protection against ricocheting blobs of flame fuel, the blast of flame, and hot gases. In foxholes and fortifications, blankets or shelter halves afford some protection, particularly if they are wet and are used to cover the position or entrances to it. Standard clothing and sleeping equipment also offer some personal protection.

b. Ventilation. Casualty effects of flame are reduced in well-ventilated positions. Commanders must decide whether to prescribe additional ventilation based on the possibility of flame attack as compared to attack by small arms, grenades, and other weapons. Holes may be opened in houses or basements by blasting; holes may have to be provided in deliberate fortifications. Increased ventilation does not prevent the temporary neutralization of the position while it is under flame attack.

c. Camouflage and Dispersion. Despite the value of individual cover, camouflage and dispersion are also important elements in the de-

★APPENDIX A
REFERENCES

A–1. Army Regulations (AR)

310–25	Dictionary of United States Army Terms.
310–50	Authorized Abbreviations and Brevity Codes.
385–63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.

A–2. Field Manuals (FM)

5–15	Field Fortifications.
5–25	Explosives and Demolitions.
(C) 5–31	Boobytraps (U).
7–10	The Rifle Company, Platoons, and Squads.
20–32	Landmine Warfare.
20–60	Battlefield Illumination.
31–25	Desert Operations.
31–50	Combat in Fortified and Built-Up Areas.
31–71	Northern Operations.
31–75	Riverine Warfare.
100–26	The Air-Ground Operations System.

A–3. Technical Manuals (TM)

3–366	Flame Fuels.
3–1040–204–14	Operator's Organizational, DS, and GS Maintenance Manual (Including Repair Parts and Special Tools List): Flamethrower, Portable, M2A1–7, FSN 1040–586–4560.
3–1040–206-series	Flame Thrower, Mechanized, Main Armament, Turret-Mounted, M7A1–6.
3–1040–209–12	Organizational Maintenance Manual: Flame Thrower, Mechanized, Main Armament, M10–8.
3–1040–219–12	Operator's and Organizational Maintenance Manual: Service Unit, Flame Thrower, Truck-Mounted, M4A2(D) and Service Unit, Flame Thrower, Truck-Mounted, M4A2(IR) (DAVEY) FSN 1040–740–1152 (INGERSOLL-RAND) FSN 1040–740–1150.
3–1040–256–12	Operator and Organizational Maintenance Manual: Service Unit, Flamethrower, Tracked-Vehicle Mounted, XM45E1.
3–1040–257–12	Operator and Organizational Maintenance Manual: Flame Thrower, Portable, M9E1–7.
3–1055–218–12	Operator's and Organizational Maintenance Manual: Launcher, Rocket: 66mm, Four-Tube, XM202.

A–4. Tables of Organization and Equipment (TOE)

9–1345–200	Land Mines.
3–32	Headquarters and Headquarters Detachment, Chemical Group.
3–266	Headquarters and Headquarters Detachment, Chemical Smoke Generator Battalion.
3–500	Chemical Service Organization.

A-5. Miscellaneous

ASubjScd	3-3	Employment of Smoke and Flame.
	3-10	Portable Flamethrower Training.
DA Pam	310-1	Index of Administrative Publications.
	310-3	Index of Doctrinal, Training, and Organizational Publications.
	310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.

APPENDIX B

PORTABLE FLAMETHROWER GUNNERY

Section I. TRAINING

B–1. General

a. Before firing a portable flamethrower, a soldier must receive certain preliminary training. He should have at least a general knowledge of the functioning of the weapon and be familiar with the servicing and maintenance procedures involved in preparing it for use. He must understand the firing procedure for the particular type of flamethrower he will be firing as well as the correct principles of aiming and positions. He should be familiar with all safety features of the weapon and with safety precautions to be taken before, during, and after firing.

b. Schedules and lesson outlines for training portable flamethrower gunners are described in Army Subject Schedules 3–3 and 3–10. Details of functioning, servicing, and maintenance are described in the technical manuals pertaining to the particular type of portable flamethrower. Fuel mixing and evaluation are described in TM 3–366. Safety precautions and firing ranges are discussed in AR 385–63.

★*c.* Although the procedures discussed in the following paragraphs of this appendix are for the M2A1–7 portable flamethrower, the principles involved are also applicable to the M9–7 and M9A1–7 portable flamethrowers.

B–2. Firing Procedure for the M2A1–7 Portable Flamethrower

a. Adjusting the Carrier. Before beginning a flame mission, insure that the carrier is adjusted so that the tank group will ride as comfortably as possible on your back. Check to see that the lacing which holds the carrier to the tank group is tight enough to keep the metal tank group from irritating your back. Adjust the shoulder straps so that the tank group rides high, but not so tight that they restrict blood circulation in your arms. The body strap should be tight enough to prevent the tank group from bouncing excessively when you run. Check to see that the quick releasing fasteners function properly.

b. Placing the Flamethrower on the Back. If there is someone nearby to help, have him lift the flamethrower while you put your arms into the straps. If there is no one to help, place the flamethrower upright on the ground, sit down with your back against the carrier, and then put your arms into the straps. To get up, hold the gun group by the barrel with your right hand and roll over on your left knee, pushing up with your left hand. Be careful that you do not accidentally squeeze either the trigger or the fuel valve lever.

c. Opening the Pressure Tank Valve. The pressure tank valve controls the flow from the pressure tank to the fuel tanks. This valve should be opened *slowly* to lessen the possibility of malfunction and in combat situations should be opened before the gunner gets within hearing range of the enemy, since the compressed air or nitrogen makes a hissing sound when it flows into the fuel tanks. However, the valve should not be opened too soon, because the compressed air or nitrogen may drain off through small leaks in the pressure system. Open the pressure valve all the way to allow the compressed air or nitrogen to flow to the fuel tanks easily. Wait until the hissing sound stops before attempting to fire the flamethrower.

d. Firing.

(1) *Controlling the fuel.* The fuel is controlled by the fuel valve lever. In order to operate this lever, depress the valve safety lever at the same time. The ignition grip of the M7 gun group can be rotated and adjusted to suit the gunner. Be sure to depress the fuel valve lever all the way or else the fuel may not escape from the gun with sufficient force to reach the target. Release the fuel valve lever as soon as the fuel is exhausted. You can tell when the fuel is exhausted by a definite change of sound.

(2) *Controlling the ignition.* Fuel ignition is controlled by the ignition lever. On the M7 gun group, you cannot depress the ignition lever unless you depress the ignition safety lever at the same time. Several techniques are used to ignite the fuel. You may desire to wet the target with fuel before you ignite it. In this case, first depress the fuel valve lever, allowing the unignited fuel to go to the target. Then ignite the fuel by firing an ignited burst at the target. Normally, you will depress the ignition lever first and then the fuel valve lever one or two seconds later to ignite and project the fuel to the target. There are five charges in the ignition cylinder. Each of these charges will burn for 8 to 12 seconds. In very cold weather or when using a poor grade of fuel, it may be necessary to use two or more charges at the same time in order to ignite the fuel. This can be accomplished by depressing the ignition lever, releasing it, and depressing it again for each additional charge which the gunner wishes to fire from the ignition cylinder.

e. Post-Firing Actions.

(1) *Remove the ignition cylinder.* After the firing mission is completed, remove the ignition cylinder in the following sequence:

(*a*) Point the gun at the ground until the ignition shield has cooled.

(*b*) Press the nozzle shield latch.

(*c*) Unscrew the nozzle shield and allow the ignition cylinder to fall out. (Care must be taken to keep the hands away from the front of the cylinder.)

(*d*) Save partly used cylinders for future use or expend them by firing them from the gun after the fuel tanks have been emptied.

(2) *Close the pressure tank valve.* If additional shots are to be fired before refilling or recharging, close the pressure tank valve by turning the valve handle clockwise to conserve remaining pressure.

(3) *Release the pressure in the pressure tank.* If no additional shots are to be fired before refilling and recharging, open the pressure tank valve by turning the handle counterclockwise. Point the gun in a safe direction and blow out the remaining fuel and pressure by squeezing the fuel valve lever and valve safety lever until there is no further discharge. (Do not use the ignition lever during this operation.) Then close the pressure tank valve to keep foreign matter out of the pressure system.

(4) *Remove the tank group.* Carefully remove the tank group from your back. This can be done most easily by sitting or squatting with your back to a tree stump, flat rock, packing box, or other object; releasing the body and shoulder straps; and easing the tank group from the back. Avoid dropping equipment as this may damage it.

★(5) *Open the bleeder valves.* After you remove the tank group, open both bleeder valves to make certain that there will be no further buildup of pressure in the fuel tanks. Unless you open these valves, the pressure may build up because of a leaking pressure tank valve or because of the heating and expansion of air inside the fuel tanks. (To bleed pressure from the M9A1–7 flamethrower, turn fuel tanks upside down—resting on plastic cover—and bleed pressure through the gun.)

Caution: **Do not disconnect the gun group from the tank group while there is pressure in the fuel tanks.**

(6) *Perform after-firing maintenance.* Inspect, clean, and service the flamethrower as described in TM 3–1040–204–14 for after-firing maintenance.

B–3. Positions

a. General. You can fire the flamethrower from any position that permits sufficient freedom to aim the weapon, subject to the following conditions:

(1) During firing, the bottoms of the fuel tanks must always be substantially lower than the tops. Tanks must not be tilted to either side; otherwise, only a small part of the fuel will be blown from the tanks.

(2) Stability must be sufficient to withstand the recoil from the gun.

(3) Full advantage should be taken of such cover and concealment as shell craters and vegetation.

b. Standing Position. The portable flamethrower is most often fired from the standing position (fig B–1). To assume the standing position, grasp the fuel valve lever grip with your right hand and the ignition lever and ignition safety lever with your left hand. Face the target and execute a half right face; then step toward the target with your left foot so that your feet are a comfortable distance apart and your left foot is pointed in the general direction of forming any part of the examination, he receives no credit for that particular part of the test.

e. The examining board may deduct no more than the stated value for any part of the test.

f. Each candidate fires the firing table (para B–19*k*) at least once before taking the marksmanship phase of the qualification course.

g. Notes for examining board are as follows:

(1) A starting point should be provided for each target at least 30 meters from the maximum range allowed for engaging the target.

(2) Each target should be approximately 1-meter wide, 1-meter thick, and 1/2-meter high, and plainly visible to the gunner at the required range to engage the target.

(3) Each target must have an aperture approximately 30 by 75 centimeters on each of its four sides. The apertures must be in line with each other or connected within the target so that flame penetration may be observed.

(4) The eight targets should be spotted over an area in zigzag pattern. The distance between the starting positions and targets Nos. 1 through 4 should vary between 50 and 75 meters. The distance between the starting positions and targets Nos. 5 through 8 should vary between 75 and 100 meters.

(5) The technical information regarding the operation and functioning of the portable flamethrower may be obtained from TM 3–1040–204–14.

B–17. Subjects and Ratings

a. Nomenclature and Functioning.

(1) Nomenclature and functioning of the pressure system	6 points
(2) Nomenclature and functioning of the fuel system	6 points
(3) Nomenclature and functioning of the gun group	6 points
(4) Removal and replacement of the ignition cylinder	2 points
	20 points

b. Mixing the Fuel and Charging the Flamethrower.

(1) Mixing the fuel	5 points
(2) Evaluating the fuel	2 points
(3) Filling and charging the flamethrower	8 points
	15 points

c. Marksmanship.

(1) Firing in open area:	
(*a*) Kneeling	10 points
(*b*) Standing	6 points
(*c*) Standing	6 points
(*d*) Kneeling	10 points
	32 points
(2) Firing in heavily wooded area:	
(*a*) Kneeling	14 points
★(*b*) Standing	10 points
★(*c*) Standing	10 points
(*d*) Kneeling	14 points
	48 points

d. Care and Cleaning.

Cleaning the flamethrower after firing	20 points
Total credit	135 points

B–18. Examination Equipment

The following equipment is available to each candidate for the examination.

a. M2A1–7 portable flamethrower (empty).

b. Cleaning material.

c. Grease, lubricating, automotive and industrial, type A, grade 2.

d. Oil, lubricating, preservative, special.

e. Gasoline.

f. Fuel thickener, M1 or M4.

g. Mixing buckets or empty fuel drums.

h. Wooden paddle for mixing fuel.

i. Liquid measures of gallon and quart capacity.

j. Scales for weighing thickener.

k. Funnel.

l. Ignition cylinder.

★*m.* Nitrogen or compressed air cylinders coupled in manifold, with at least one cylinder charged with 1,700 to 2,100 pounds of pressure per square inch, or AN–M4 compressors. The M27 service kit is used with either the cylinders or the compressors.

n. Tool roll for portable flamethrower.

B–19. Details of Performance

a. Test on the Nomenclature and Functioning of the Pressure System.

(1) *Situation.* Provide each man with a tank group.

(2) *Requirement.* Give the nomenclature and describe the functioning of the pressure system; trace the flow of pressure from the pressure tank to the fuel tanks in the correct sequence.

(3) *Scoring.* Give six points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in the proper sequence.

(*a*) Pressure tank.
(*b*) Pressure tank valve.
(*c*) Regulator tube.
(*d*) Pressure regulator.
(*e*) Safety head assembly.
(*f*) Diffusion tube.
(*g*) Fuel tanks.

b. Test on the Nomenclature and Functioning of the Fuel System.

(1) *Situation.* Provide each man with a complete flamethrower.

(2) *Requirement.* Give the nomenclature and trace the flow of fuel from the fuel tanks to the ignition section in the correct sequence.

(3) *Scoring.* Give six points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in sequence.

(*a*) Fuel tanks.
(*b*) Tank connector.
(*c*) Quick release coupling.
(*d*) Fuel hose.
(*e*) Barrel and valve assembly.
(*f*) Ignition section.

c. Test on the Nomenclature and Functioning of the Gun Group.

(1) *Situation.* Provide each man with a complete gun group.

(2) *Requirement.* Give the nomenclature and describe the functioning of the four assemblies of the gun group.

(3) *Scoring.* Give six points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in sequence.

(*a*) Fuel hose.

(*b*) Valve section (consists of the valve lever, valve safety lever, inlet body, barrel, and nozzle).

(*c*) Ignition section (consists of the ignition lever, ignition safety lever, nozzle shield, and ignition pin).

d. Test on the Removal and Replacement of the Ignition Cylinder.

(1) *Situation.* Provide each man with a complete gun group with an ignition cylinder installed.

(2) *Requirements.* Remove and replace the ignition cylinder.

(3) *Scoring.* Give two points for correctly completing the requirement according to the following checklist. Give no credit if any part is missed or not in sequence.

(*a*) Depress the nozzle shield latch.
(*b*) Remove the nozzle shield.
(*c*) Remove the ignition cylinder.
(*d*) Replace the ignition cylinder.
(*e*) Properly seat the ignition cylinder.
(*f*) Replace the nozzle shield.

e. Test on Mixing Thickened Fuel.

(1) *Situation.* Provide each man with the necessary equipment for mixing thickened fuel (para B–18 above).

★(2) *Requirement.* Mix 1 gallon of Number 2 flame fuel, based on guidance contained in TM 3–366.

(3) *Scoring.* Give five points for correctly completing the requirement. Give no credit if all requirements in the following checklist are not observed:

(*a*) Use clean containers to mix fuel.

(*b*) Mix the fuel and thickener in correct proportion.

(*c*) See that the thickener does not settle to bottom.

(*d*) See that the thickener is not in lumps in the mixture.

(*e*) See that the fuel does not begin to gel before all thickener has been added.

(*f*) Do not use galvanized metal containers.

f. Test on the Evaluation of Fuel.

(1) *Situation.* Provide each man with several batches of thickened fuel.

(2) *Requirement.* Select the batch of thickened fuel best suited for firing from the portable flamethrower, based on information contained in TM 3-366.

(3) *Scoring.* Give two points for correctly completing the requirement. Give no credit if the best fuel is not selected.

g. Test on Filling Fuel Tanks and Charging Pressure Tanks.

(1) *Situation.* Provide each man with the

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